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Incorporating RADIO, TELEVISION & HOBBIES

OCTOBER, 1965
2/6
Vol. 27 No. 7

RADIO, TELEVISION, HI FI, ELECTRONICS, AMATEUR RADIO, POPULAR SCIENCE, HOBBIES.

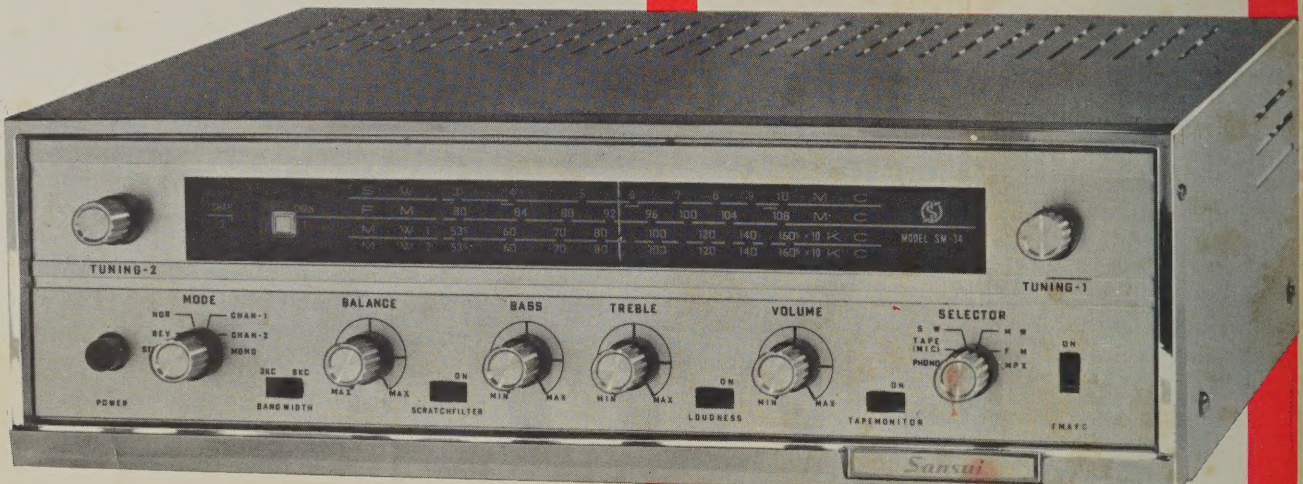
"FLYING COMPUTER" FOR THE RAAF

Registered in Australia for transmission by post as a periodical

THE Sansui

HI-FI STEREO TUNER AMPLIFIER

MODEL SM-34



This is one of the best amplifiers to come from Japan, and, if used with a pair of A.W.A. bookshelf loudspeakers, type 1D94667, is capable of reproducing superb hi-fi programmes.

As well as the normal dual channel amplifier, the Sansui contains a dual channel tuner for stereo or dual reproduction of the standard broadcast band and a single channel for the reception of short-wave and FM sound.

With the Sansui, even programmes from standard broadcasting stations sound better. The full richness of tone and faithful reproduction of this system are just not possible with the normal broadcast receiver.

The SM-34 is fitted with a scratch filter to reduce the noise when playing those older records and a dynamic expander circuit to maintain the proper balance between loud and soft passages of recorded music.

BRIEF SPECIFICATION

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Output:
Max. 32 watts total; 16 watts per channel

Frequency Response:
—2 db, 20 c/s to 80 kc/s

Harmonic Distortion:
Less than 1% at 13 watts, each channel

Output Impedance:
8, 16, 32 ohms each channel

Pre-Amplifier Each Channel:
Sensitivity and Gain:

Gram. Pick-up:
Magnetic: 2 mV for 12W output
Crystal: 50 mV for 12W output

Tape and Mic.:
1.1 mV for 12W output

Aux.:
70 mV for 12W output

Signal-to-noise ratio:
Better than 55 db (at tape output)

Tuner Ranges:

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AM B'cast 535 to 1605 kc/s

Channel 1:
AM S.W. 3.5 to 10 Mc/s

Channel 1:
FM 80 to 108 Mc/s

AWA

For further particulars please contact Engineering Products Division

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FUTURE OF SERVICING

THE attention currently focusing on modular techniques and microstructures has caused understandable speculation about the future of the electronic servicing industry. Will today's servicemen give place to a race of "module jockeys" having, as their stock in trade, a box of replacement modules and a book of symptom charts?

Those who forecast such a trend point to: the growing acceptance of the module concept in design; the ultimate economy and reliability of automated production and testing, particularly in respect to microstructures; the fact that this kind of equipment doesn't lend itself to the detailed fault finding and fault fixing in the field; the further fact that it may become cheaper to replace than repair.

Against this, there are those who maintain that modules and microstructures are all very well for computers and specialised equipment but they will never "take on" in the consumer field; that there will always be a place for the traditional serviceman, with his multimeter, his soldering iron and his puckered brow.

Reality, I think, lies between these extreme views. For certain consumer products there is no special pressure to change traditional assembly and design methods. But they are changing, nevertheless, as valves and wiring gradually give place to printed boards and transistors, to unit designs, to modules and ultimately to micromodules.

Already we have reached the stage where servicing miniature portables is a matter for specialists and where inefficient service procedures, on a time basis, can involve charges out of all proportion to the first cost of the unit. As the problems multiply with decreasing dimensions, the pattern must surely move through (1) specialist servicing (2) throw-away subassemblies or modules and, conceivably (3) throw-away receivers.

In short, the pattern of servicing will change, gradually but inevitably, with on-the-spot trouble-shooting giving place to the replacement unit approach. This pattern is already well established in the automotive and other industries. Today's "tube jockeys" will become the "module jockeys" of tomorrow but I don't believe, for one minute, that this will be the extent of tomorrow's service industry.

With the vast expansion of electronic devices, there will remain ample scope for know-how and initiative.

Williams

October, 1965

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COVER PICTURE

Lockheed's P-3 Orion is equipped with the most advanced yet detect-and-destroy electronic equipment to "kill" submarines. The R.A.A.F. is to be armed with 10 Orions in 1968. Described as a "flying computer" the Orion's cabin is packed with 2½ tons of electronic gear interconnected by data transmission links and including a unique data display system. It carries a crew of 10.

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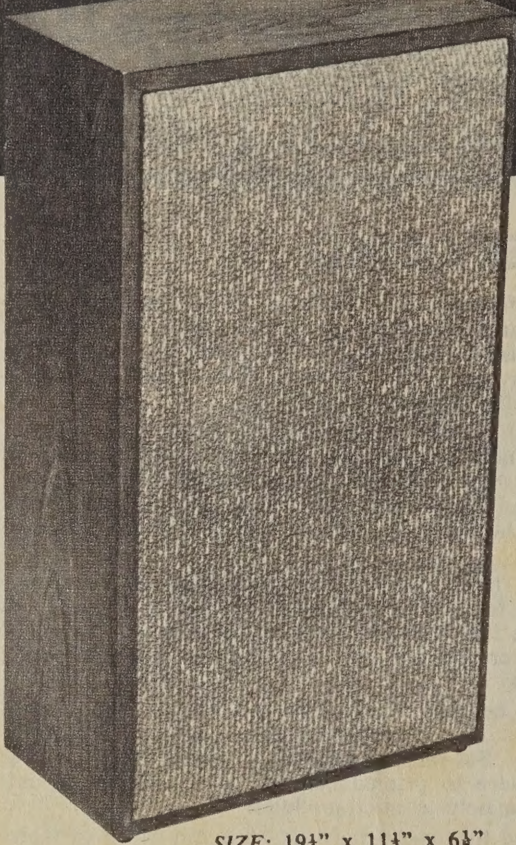

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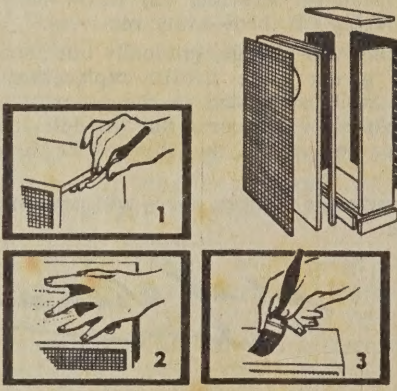

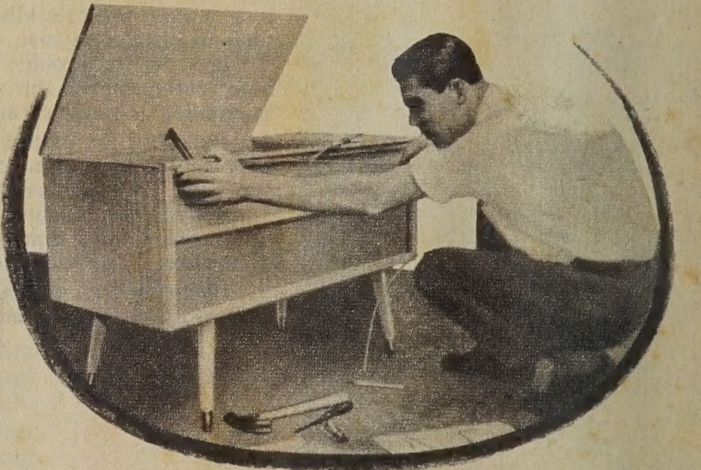

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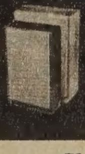

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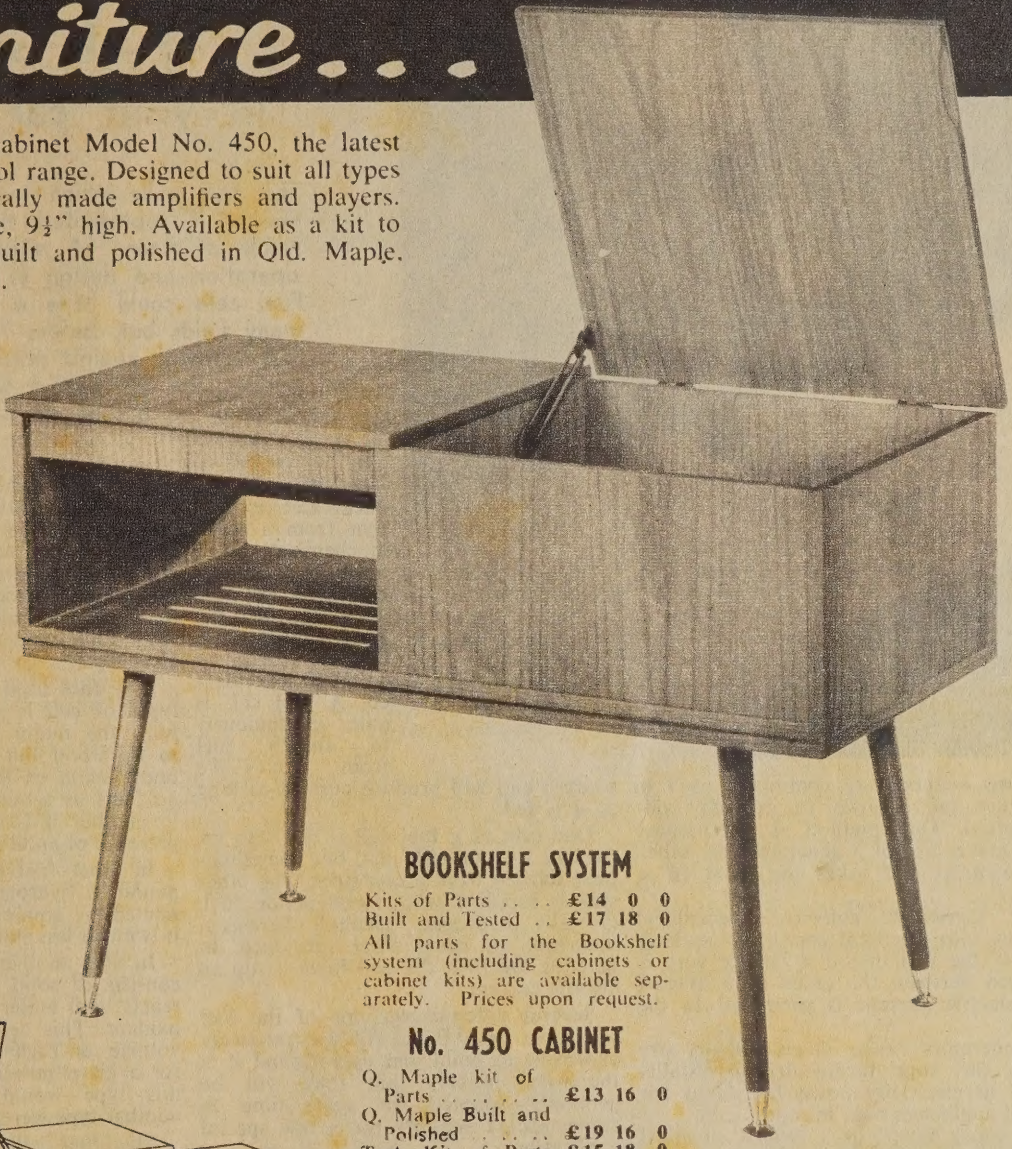

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Teak, Built and Polished	£22 16 0

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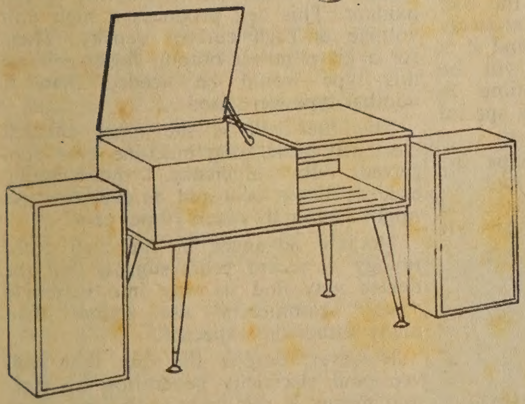

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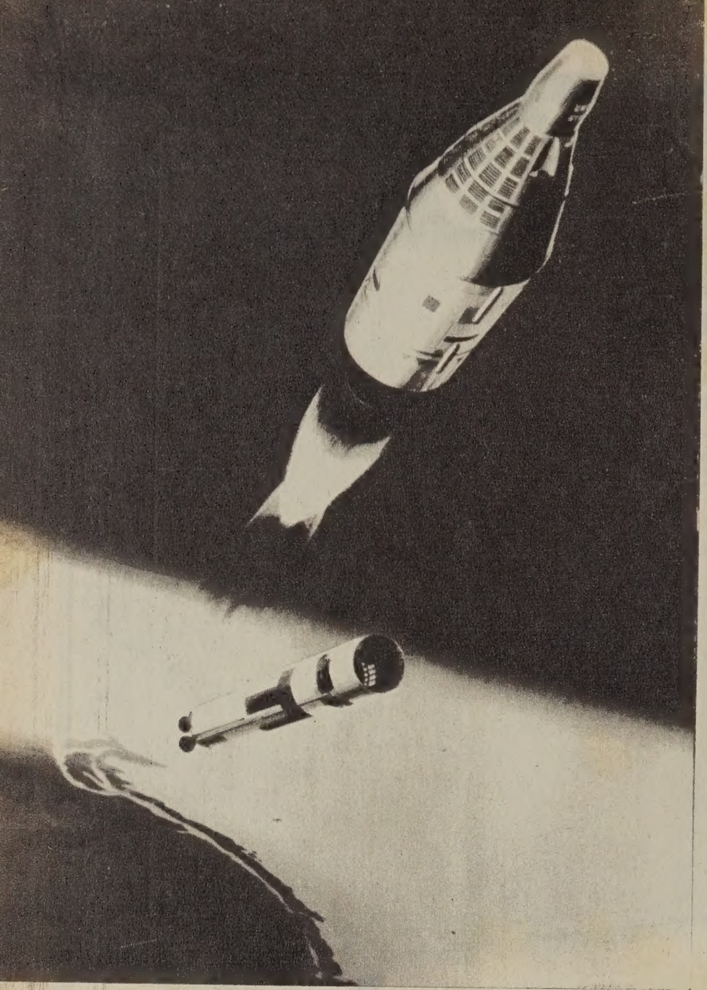


FUEL CELLS

—In space today
In your car tomorrow!

The fuel cells which went aloft with Gemini V represented the spectacular result of years of research into the operation and design of such devices. Fuel cells could have a big future in many fields but, before they can make real headway against present-day power sources, the cost barrier will have to be broken down.

Two methods are commonly used to produce electric power for everyday consumption. One method is mechanical and makes use of a generator; the other is chemical and takes the form of a battery.

A generator converts mechanical energy into electrical energy by making use of the fact that if a coil of wire is rotated between the poles of a magnet an electric current is generated in the wire.

Generators range downward in size from the huge turbine-driven installations in electricity power-houses to the small appliances used in motor cars.

A torch battery is a typical chemical producer of electricity, and consists of an electrolyte and two electrodes. The electrolyte used is a paste of sal ammoniac. One electrode is of thin zinc sheet and forms the casing of the battery. The other electrode is a carbon rod in the centre of the battery. Under the stimulus of the electrolyte, the zinc electrode gives off ions which are received by the carbon electrode and thus an electric current is created.

After the chemical constituents of a dry cell battery have been exhausted the battery is usually discarded. It would not be economic to replace the component elements to bring it back to operational efficiency.

Another device for producing an electric current is receiving much attention from research scientists all over the world. This is the fuel cell, which converts the chemical energy of fuels directly, without combustion, into electric power.

The fuel cell has been described as a first cousin to the torch battery, but there is one vitally important difference between them:

A battery produces electric current from a built-in chemical supply until that supply has been exhausted, after which the battery must either be discarded or parts of it replaced. A fuel cell is able continuously to absorb fuel from outside sources and will produce current as long as it is fed.

One side of a fuel cell is fed with an oxidant — normally air, but sometimes pure oxygen from a container. The other side is supplied with a companion fuel, typically hydrogen, alcohol, kerosene, methanol, or some other substance. In reacting together, the two fuels set up an electric current.

Several different versions of the fuel cell have been built. All are relatively expensive to build and operate and it is therefore unlikely that they will be generally adopted for some time to come, except possibly for a few special applications.

Probably the first and perhaps the only industrial application of a fuel cell to date can be credited to the Pratt and Whitney Division of United Aircraft Corporation, which in October, 1962 supplied a 500W unit as the power source for the electronic instrument system at a natural gas compressor station in Stanton, Kentucky. This cell had a nickel anode, nickel oxide cathode and used an aqueous solution of potassium hydroxide (caustic potash) as electrolyte.

The fuel used in some of the latest types of cell is methanol (methyl alcohol), the major source of which used to be wood but is now petroleum. In one version of the fuel cell the methanol acts as a source of hydrogen while in another it is oxidised directly in the presence of an acidic electrolyte.

In other fuel cells hydrazine, a compound of hydrogen and nitrogen closely related to ammonia, is being used, but it is much less stable than hydrogen.

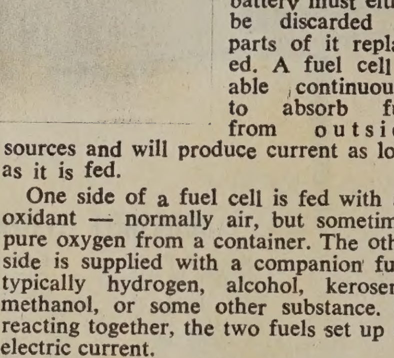
In still another type of cell, the fuel consists of solid metallic barium which reacts with either air or chlorine as the oxidant. This cell produces a high unit voltage at high current density. Thus, for a given power output, fewer cells of this type would be needed than if another type were used.

The fuel cell is the most efficient electricity generating machine ever conceived. Its efficiency, theoretically, exceeds 90 per cent and, in everyday use might eventually reach 70 per cent.

Notable advances in fuel cell technology in recent years suggest that the device may find its way into extensive "local" commercial use sooner than many authorities expected.

However, despite the fact that conventional electricity generation by thermal means is relatively inefficient, there seems little prospect so far of fuel cells being employed in this sphere. But this prospect, too, could be brought much closer if a suitable cell were designed to operate at relatively low temperatures on natural gas, which is plentiful in certain areas.

For electricity-generating authorities another attractive, if distant, possibility is the use of fuel cells for peak-period power generation. Surplus energy from conventional (or nuclear) plants could be used during off-peak hours to produce hydrogen and oxygen which would be stored in gas holders, then fed into fuel



The fuel cell consists of two porous electrodes separated by an electrolyte, and supplied respectively with fuel and oxygen. Chemical energy of the fuel is converted directly into electricity without combustion.

cells to yield the extra power needed to meet peak demands.

The first fuel cell was demonstrated as long as 126 years ago by Sir William Grove in Britain but it was regarded at the time merely as a curiosity. Like the legendary companion of the man who invented the wheel, far back in antiquity, people of the day doubted whether it would ever have any practical use.

It was not until 1932 that interest was revived in fuel cell theory by the investigations of F. T. Bacon, a Cambridge scientist, who first envisaged the possibility of its widespread development as a large-scale source of electric power.

Since then, particularly since World War II, scientists in Britain, the United States, Germany, Russia, Sweden, and other countries, including Australia, have been trying to make fuel cells capable of commercial use.

The first project to hit the headlines was Bacon's device which produced 2¼ kilowatts at 32 volts from a cylinder 15in by 30in. It was demonstrated in 1959 as the source of power for a small welding apparatus and a fork-lift truck. It used hydrogen as fuel, and pure oxygen as oxidant.

Mass manufacture of a cell of this type has never seemed probable, mainly because pure hydrogen and oxygen are neither cheap, widely available, nor convenient to store.

It has not even been made more likely by the development, encouraging though it is, of a catalytic method of obtaining hydrogen from methanol, and applying this in a cell which uses air instead of pure oxygen as the oxidant.

While the provision of a steady source of hydrogen is thus no longer a problem, the solution adopted brings in its train another, different disadvantage — the high cost of the catalyst required.

Much recent effort has therefore been devoted to the search for ways of using relatively cheap materials such as methanol or liquid hydrocarbons (for example, gasoline or kerosene) as fuels, rather than hydrogen sources, in cells whose operating temperatures are relatively low.

In spite of all the difficulties encountered, significant progress has been made in several countries.

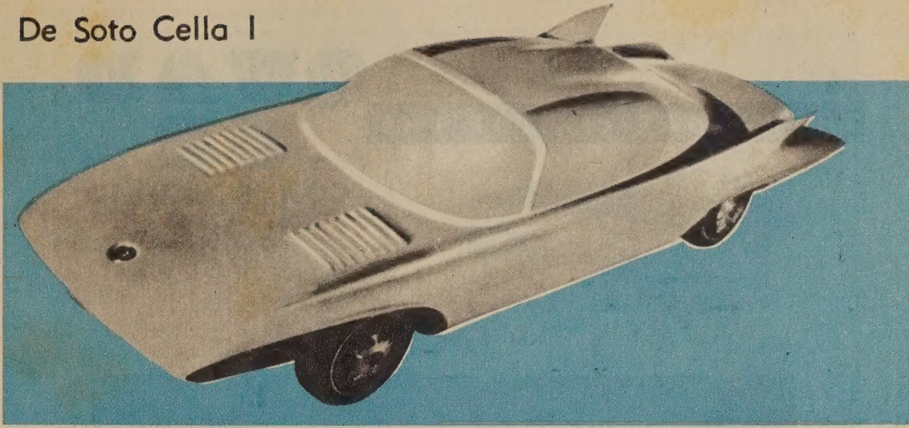
In Britain, for instance, scientists at the Shell Research Centre at Thornton, near Chester, have developed a fully integrated fuel cell power unit for the British Ministry of Aviation and have demonstrated it in an electric hammer used for breaking concrete. The unit is small enough to be mounted on a 15cwt utility vehicle.

It consists of two assemblies of 62 fuel cells each. The fuel is hydrogen, produced by reacting methanol with steam in the presence of a catalyst. After purification, it is fed into each assembly, for which the oxidant is air supplied from a low-pressure blower. Net thermal efficiency of the unit is between 50 per cent and 60 per cent. Its nominal power output is 4KW but it has actually produced more than 5KW.

In addition to this net output, the unit produces a further 900W of energy that is consumed in operating the air blower, the electrolyte circulating pump, the hydrogen generator, and the cooling fan.

These operations cause the unit's thermal efficiency to be lower than it otherwise would be, but it is still much higher than that of a gasoline-electric generator of similar power output and comparable, in fact, with that of a diesel-electric generator. Also the operation of the unit is much quieter than either.

De Soto Cella I



When it is remembered that the modern diesel-electric generator has been developed over a period of 60 years while the fuel cell generator is still in an essentially experimental stage, this is no mean achievement. It would be foolish to doubt that much higher efficiencies will be attained in future models.

Fuel cell research in Britain is not confined to Shell's Thornton Centre. It is being undertaken by various other organisations, including Energy Conversion Ltd., a company set up in 1961 in which BP has a one-quarter interest. The company's laboratories are located not far from BP's research headquarters at Sunbury-on-Thames.

In the United States, the Esso Research and Engineering Co. has designed a fuel cell unit for the U.S. Army Electronics Command and has tested it in military radar and radio equipment. It produces about 100W of electricity and operates at 140 deg. F. Its overall operating efficiency is 23 per cent at peak load and 40 per cent at half maximum power.

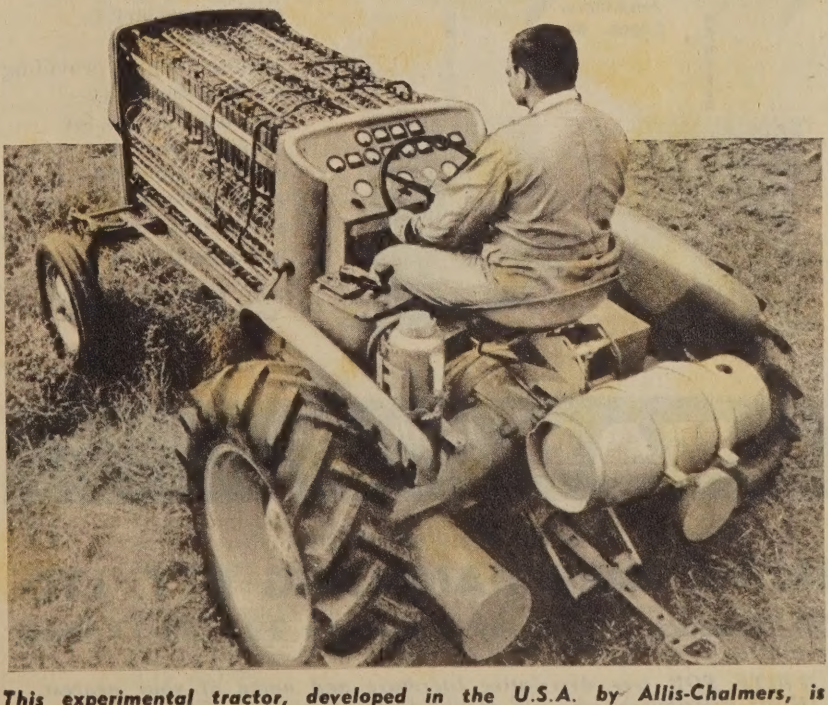
Compared with this, the efficiency of the present-day automotive engine is only about 15 per cent and that of the most modern electricity generating facilities only 40 per cent.

Tests are now being carried out on fuel cells to be installed in American space vehicles, including Apollo, due to be moon-bound in 1970. These units not only supply power for instruments and telecommunications systems equipment, but produce water suitable for drinking by astronauts.

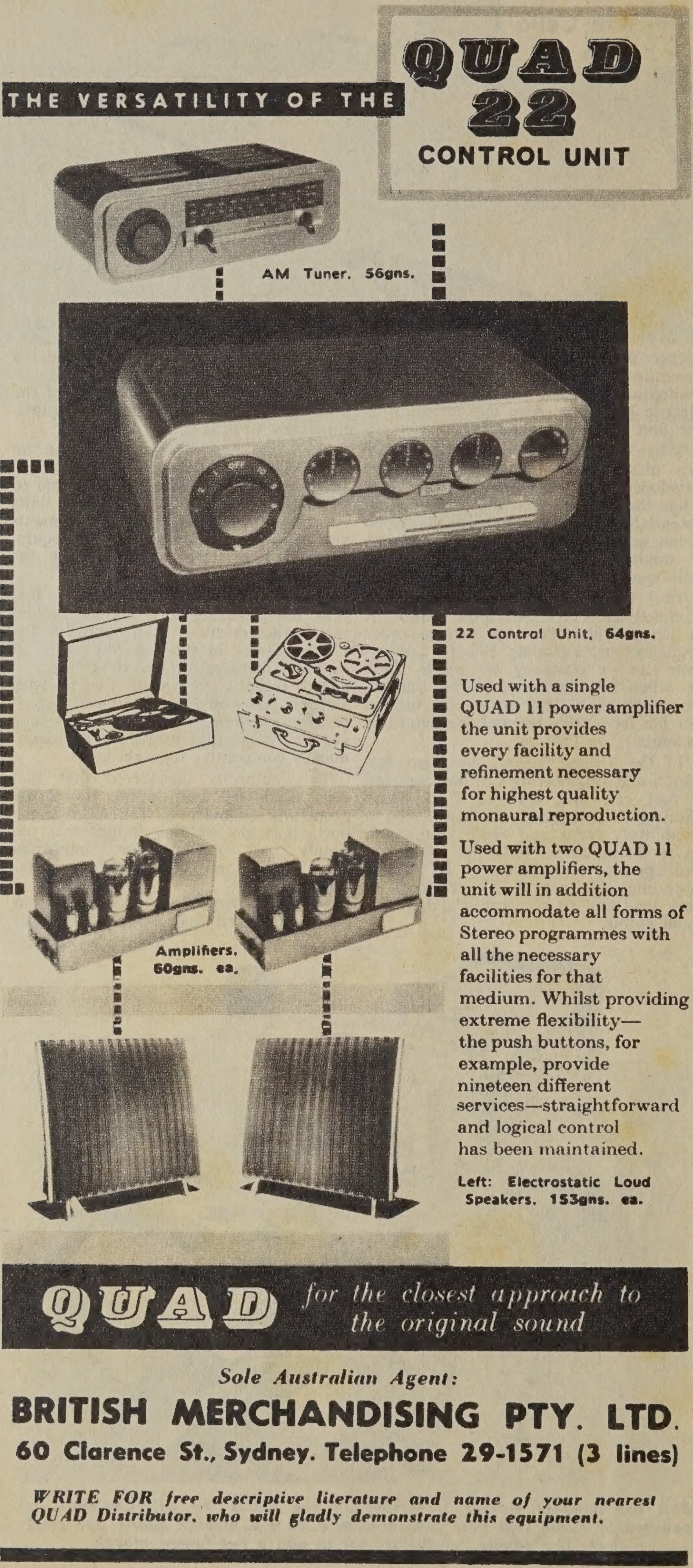
Demonstrations of the use of fuel cells for powering fork lift trucks and small tractors have been given in the United States in the last few years. A leading American fuel cell developer predicted recently that cells fuelled with natural gas would be technically competitive with other fuel cells within four years although they would not be economically competitive for eight years.

This authority considered that fuel cells would be used in the future for propelling submarines, for road transport, portable welding equipment, the supply of power for industries and homes, and for numerous other purposes.

Since this prediction was made, it has been announced that a fuel cell power



This experimental tractor, developed in the U.S.A. by Allis-Chalmers, is powered by 1,008 fuel cells connected to a 20 h.p. electric motor. Sufficient power is produced for the tractor to pull a two-furrow plough.



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unit is being constructed in Sweden for the propulsion of a small submarine.

In Australia the C.S.I.R.O. and the aeronautical research branch of the Department of Supply are the authorities concerned with fuel cell research work.

The C.S.I.R.O. is interested mainly in constructing a low temperature cell in which methanol or hydrocarbon liquid fuels can be used. Such a cell could, among other things, provide power for the Post Office's telephone amplifying stations in remote areas. At present, power is supplied to these stations either by diesel generators or wind-driven generators, both of which need attention much more frequently than a fuel cell would.

The aeronautical research branch of the Department of Supply hopes to devise a high-temperature cell which could

Lockheed engineers test an 1800-watt fuel cell capable of powering a 2-man space vehicle for a month. It weighs 96 pounds and is fed by oxygen and hydrogen tanks weighing 1,400 pounds but it would do the job of 10,000 pounds of batteries. In addition it produces 1½ pints of pure drinking water per hour. The electrolyte is potassium hydroxide, which is not affected by the reaction. In fact, Lockheed engineers describe a fuel cell as "a battery that does not consume its electrodes."

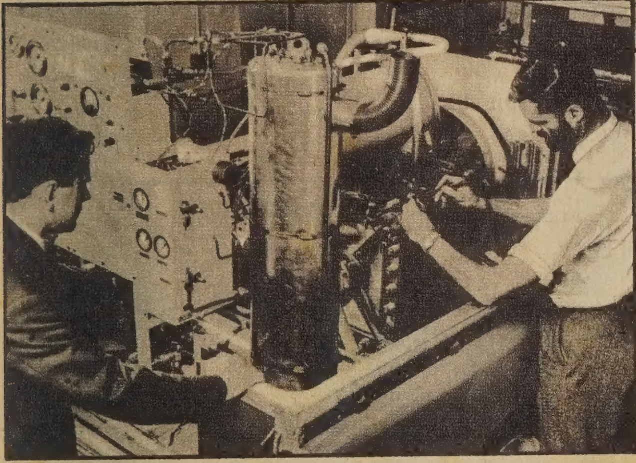
operate on a wide range of fuels, including natural gas and kerosene.

The recent discovery of natural gas at various places in Australia would make the development of a cell of this type particularly valuable.

It is as a possible replacement for the internal combustion engine in motor vehicles, however, that the fuel cell has attracted most attention.

Some authorities are firmly convinced that the advent of fuel cell motor cars is not far off. They base this opinion on the fact that it is now possible to build fuel cell-electric motor assemblies which in power-to-weight ratio, power-to-volume ratio, capital and operating costs, and performance characteristics are competitive with, and in some respects definitely superior to, conventional internal combustion engines.

It is estimated that, compared with today's typical family car, a similar vehicle would cost 10 per cent to 20 per cent less to run if powered by a direct-oxidation type fuel cell using methanol, and 30 per cent less if the fuel were liquid hydrocarbons.



A new fuel cell power unit, devised by "Shell" Research Ltd. in Britain, was tested in December last by using it to power an electric hammer (above). At left, checking the voltage of the individual cells of which there are 124, arranged in two groups of 62. Output ranges from a nominal 4KW to a peak 5KW.

Motor maintenance costs would be small because periodic attention to the motor brushes and the cleaning of the fuel and air filters would be the only servicing necessary. A motor vehicle powered by a fuel cell unit would be noiseless and free from vibration.

Several models of such vehicles have been built. The most widely publicised is a three-eighths scale model built by the De Soto Division of the Chrysler Corporation and demonstrated in the United States last year. The model was named De Soto Cella I.

Four high-speed lightweight electric motors are used to power the Cella I, each of which is geared to one of the vehicle's wheels. Lightweight reserve batteries are incorporated in the model to enable the utmost use to be made of the fuel cells' electrical output. Energy recovered from the car each time it is slowed down is stored in these reserve batteries.

In the conventional car, energy from this source is dissipated in the form of heat in the brakes and engine-cooling system. It is recovered in the fuel cell car by the dynamic or regenerative braking of the traction motors whenever the car slows down, even in ordinary traffic.

If the reserve batteries acquire more than a minimum charge, their free energy augments the electrical energy generated in the fuel cell and in this way a saving of fuel is effected.

The four lightweight motors are situated close to the car wheels and drive through short universal jointed shafts to independently suspended wheels.

They are fitted with controls by which they can be operated in series or in parallel, so that alternatively their optimum torque or high-speed characteristics, whichever is required, may be brought into service.

Light in weight as the motors are, they would need to be very much lighter in order to be mounted directly on the wheels. Such an arrangement is regarded as a future possibility by the designer of Cella I, although other experts disagree.

Because the fuel cell system renders the gearbox, the drive shaft, the differential, and the rear axle unnecessary, the passenger compartment floor of the Cella I is level.

Among other advantages that the fuel cell method of propulsion provides are maximum traction and acceleration potential, smoother operation, exceptionally good braking, absence of exhaust fumes, and almost completely silent running. All these advantages, including the last two, could each make a valuable contribution towards safer driving.

As in most branches of research work, there is always the possibility that a sudden breakthrough will be made in the design, performance, or application of the fuel cell.

Of the wide variety of uses predicted for fuel cells since Bacon's demonstration at Cambridge University six years ago captured the imagination of experts and laymen alike, very few seem likely to be widely adopted by the end of the 1960s.

But in the long run the fuel cell may turn out to be one of man's most important inventions. It could quite possibly come into such widespread use that, due to its economical fuel consumption, it might slow down depletion of the world's resources of oil and coal so that recoverable reserves could be conserved almost indefinitely.

(The foregoing article was reproduced from "Petroleum Gazette," by courtesy of the Petroleum Information Bureau Australia.)

Thermoelectric Generators

While much attention is focused on fuel cell techniques, three American corporations are pooling their nuclear know-how to develop for the U.S. Atomic Energy Commission a new generator which could power future unmanned earth-orbiting spacecraft for periods as long as five years. Headed by Lockheed Missiles and Space Company, the group includes the Nuclear Materials and Equipment Corporation of Pennsylvania and the Electronic Component and Devices Division of the Radio Corporation of America.

A Lockheed spokesman has stated, "If man is to undertake successfully interstellar travel—trips that could span several years—a long-life, on-board power system is essential. Thermoelectric generators of the type now being developed could be the forerunner for such systems."

The present contract involves design, development, fabrication and ground testing of a prototype isotopic, thermoelectric generator. Fuelled with plutonium-238, the generator will employ thermocouples to convert heat from the fuel into 75 watts of electricity.

See overleaf "The Thermoelectric World"

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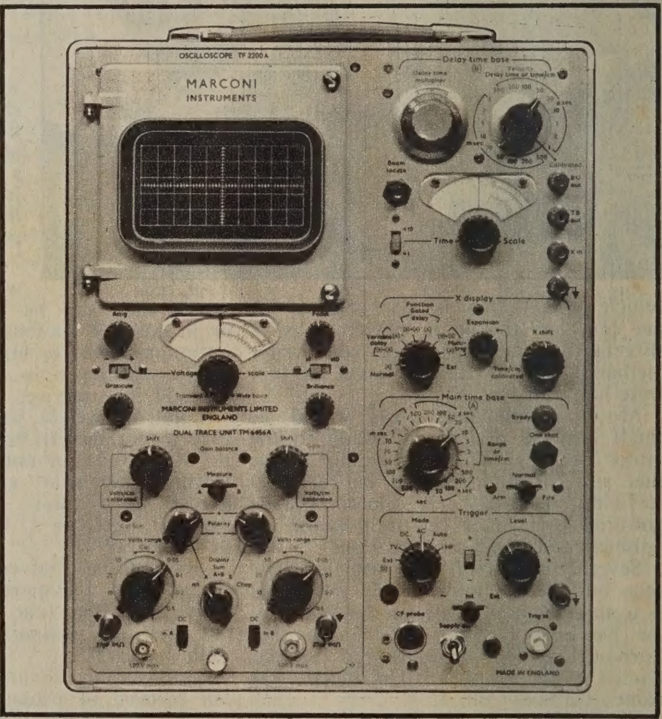

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The Thermoelectric World

by William C. Moore

The story of thermoelectrics, a technology that may someday revolutionize household heating and cooling.

WITHIN the span of most of our lifetimes, the materials that contractors will use to build our houses will consist not only of wood, bricks, stones, and nails but of modules made of semiconducting materials similar to those that operate our pocket transistor radios. These modules will be built right into the walls of our new houses. Their function will be another priceless inheritance of today's progress in electronics — completely silent and highly efficient electronic heating and air conditioning of the home with about the same reliability and life expectancy as the timbers that hold up the roof.

In this new electronic house there will be a refrigerator and freezer that will chill or freeze our foods with unprecedented accuracy as well as a toaster and clothes drier, cooking range and oven, all operating with basically the same, solid-state modules. A small attachment, which can be affixed to the baby's crib, will keep his milk to a tenth of a degree of the desired temperature. Even the car we park outside will be heated by these modules emplaced in seats, doors and roof. It will be cooled in summer by these very same devices powered by a solid-state generator that has no moving parts and derives its energy from waste exhaust heat.

All these miracles will result from a science called thermoelectrics, which is now forming the basis of a dynamic new industry.

These predictions were made by engineers and scientists of an RCA Defence Electronic Products activity called Applied Research, an organisation charged with the responsibility for taking developments emanating from the test tubes and microscopes of the laboratory and turning them into practical, usable devices. They speak with authority because they have already produced an air conditioner for submarines, spot coolers for electronic devices, cryogenic cooling for lasers — all with thermoelectrics.

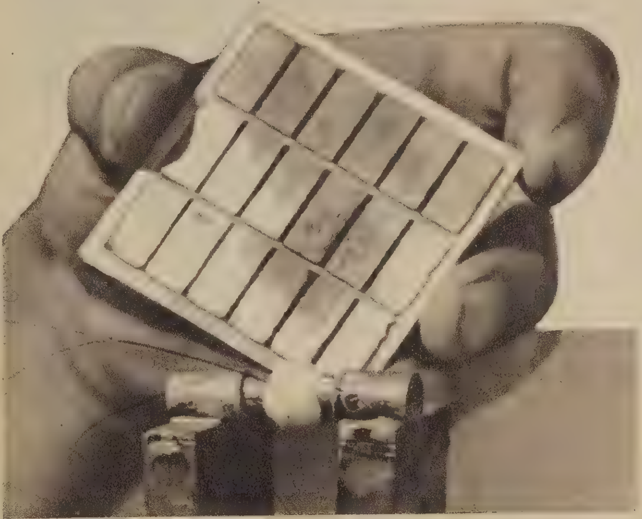
These practical researchers could say that "today, science is at the threshold of a new, space-age industry," but they use no such trite expression because thermoelectrics, now newly rediscovered, is almost as old a science as electricity itself. Actually, we have been standing at that threshold since 1821.

The first discovery of a thermoelectric phenomenon was made by the German physicist Thomas Seebeck, except for whose blunder the prophetic paragraphs above might by now have become commonplace. Only a year after the famous Danish Professor Hans Christian Oersted learned in 1820 that a magnetic needle, or compass needle, was deflected by the flow of electricity in a nearby wire — the basis of today's electromagnetic world of motors, generators, and doorbells — Seebeck observed that, if the same magnetic needle is held near a circuit comprised of two different types of conductors, it will be deflected when this circuit is heated.

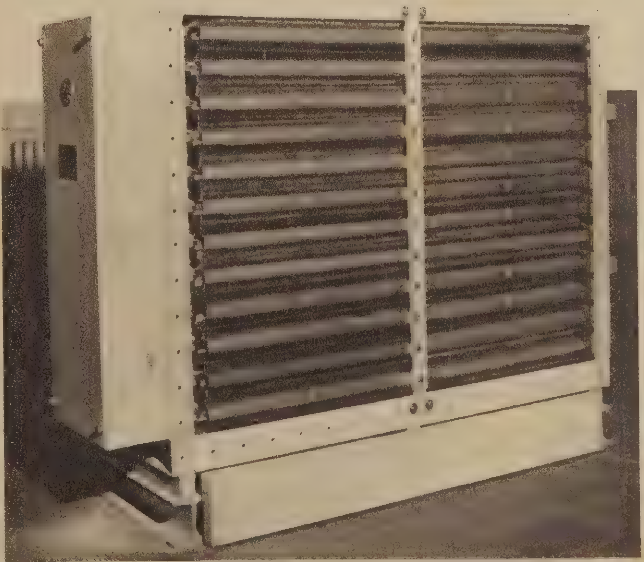
This is the basis of direct energy conversion by thermoelectric phenomenon. The heat produced the current in the circuit made of two types of conductors, and the electromagnetic field set up by the current moved the needle. Today, air conditioners, refrigerators, and automobile generators wear out and there are the whir and whine of motors and generators because Seebeck missed the boat completely, convinced as he was that he had discovered that magnetisation could be produced by a difference in temperature. So adamant was he about this interpretation that he proposed theories about the earth's magnetic field based on the difference in temperature from pole to pole. He was so convincing that none of his contemporaries looked further into his discovery in search of the truth.

Thus, Seebeck's era was deprived of an electricity-producing device as efficient as steam engines of that day, and not until 50 years later was electricity produced by a steam-driven generator.

But Seebeck was not alone in misinterpreting significant breakthroughs. In 1834, a Frenchman by the name of Jean Charles Athanase Peltier passed a current through the junction of two different conductors, and one side of the circuit became cooler and the other warmer. This thermal phenomenon, which bears his name, he also misconstrued, thinking he had found an exception to Ohm's law. Four years later, Emil Lenz built a Peltier-effect circuit, placed a drop of water on it, and ran a current through it. The water froze. He reversed the current and the ice melted rapidly. But even Lenz, with such dramatic evidence of thermo-



A typical refrigeration module, the basic thermoelectric building block, developed by RCA's Defense Electronic Products division for use in a noiseless air conditioner for submarines. Here it forms background for single thermoelectric couple shown in operation. Frost is being generated around the single couple as moisture in the air condenses upon it.



This RCA nine-ton thermoelectric air conditioner for submarines is completely silent and is only a fraction of the size and weight of conventional units.

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The KIKUSUI 539 is a simply operated oscilloscope designed for compactness and portability. It uses a 3" cathode ray tube while printed circuits and rugged construction ensure reliability and ease of service.

The vertical amplifier is stable with good characteristics; it uses a wide band push-pull circuit. The horizontal amplifier has a wide continuously variable sweep.

The 539 is provided with a convenient time base oscillator having a sweep covering 10c/s to 100Kc/s in steps with continuous variation between.

SPECIFICATIONS

Y AMPLIFIER:	Sensitivity:	Better than 1 Volt p-p/cm at 1 Kc/s
	Response:	5c/s to 1Mc/s within -3db
	Attenuator: (Frequency Compensated	Steps: unity, .1 and .02 continuously variable)
	Input Z:	1 megohm shunted by 20pF max.
X AMPLIFIER:	Sensitivity:	Better than 3V p-p/cm at 1Kc/s
	Response:	1.5c/s to 400Kc/s within -3db
	Input Z:	2.2 megohms approx shunted by 60pF max.
TIME BASE:	Sweep Freq.:	10-100c/s: 100c/s-1Kc/s: 1Kc/s-10Kc/s: 10Kc/s-100Kc/s (Continuously variable between steps)
SYNC:	Internal +, —, Line, External	
C.R.T.	3" 3KPI-F.	
POWER SUPPLY:	240V: 50/60 c/s: 36VA approx.	
DIMENSIONS:	4½" x 7¾" x 13 5/8"	
WEIGHT:	11 pounds	

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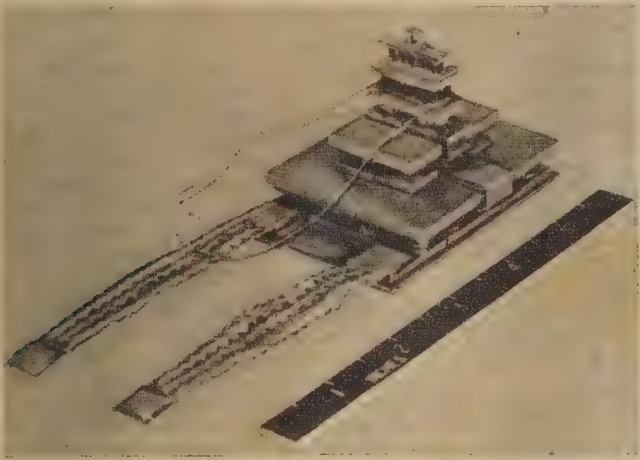
electric action put the device on the shelf and forgot about it.

Why were all these scientists so confused, so misled by the results of their experiments? Probably because it took a new technology of "holes" and charge carriers, of "N" and "P" type materials — the domain of solid-state physics — to explain and utilise fully the phenomena that were occuring. Significantly, this era has begun only recently.

In addition, the thermoelectric effects obtained from today's semiconductors and semimetals are far more efficient than those of the metals used by Seebeck, Peltier, and their contemporaries.

To explain fully thermoelectic effects, scientists tell us we must delve into the mysteries of quantum theories, but for our purposes here we can simply state that, if we heat one end of a semiconductor, electrons will flow to the cold end. Conversly, if we run the electrons to one end of the semiconductor with an applied voltage, that end will attempt to acquire heat from its surroundings (turn cold), and the acquired heat will be transferred to the opposite end, which will, of course, become hot.

One more element needs to be added to this recipe for today's Peltier-effect thermoelectric action. The semiconductor described above is an "N," or negative type, wherein electron current flow is similar to that in metals. The compatriot of the N-type material is the "P," or positive type, semiconductor, whose energy transmissions is accomplished by "holes" — or the places where electrons have been. This concept seems a bit confusing, but we are told these holes wander about in the transistors in our radios, computers, and other places where semiconductors are at work, and it appears we are obliged to accept them. In any event, the holes, essentially positive charges of the same but opposite value as the negatively charged electrons, when moved to the positive end of the semiconductor, turn that end cold.



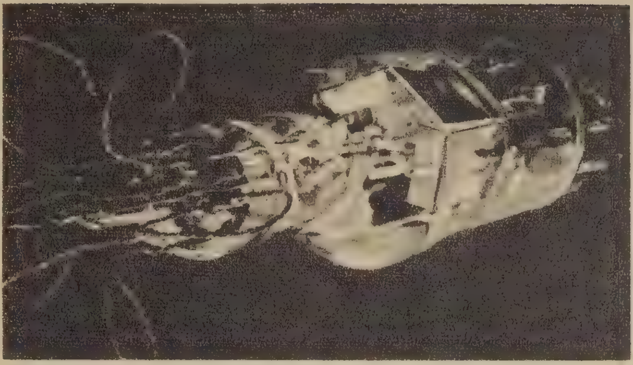
Six layers of semiconductors, separating plates of diminishing area in this experimental unit, recently produced a temperature of minus 135 degrees F. The largest plate measures roughly 3-inches square.

Now we can build a fairly efficient thermoelectric device. We put the negative end of the N-type bar, or ingot-shaped semiconductor, against a piece of metal, and against the same metal plate we put the positive end of the P-type. Then, if we run a current, from a battery perhaps, through the N-type semiconductor, the bar, and back through the P-type, the plate will get cold. If we take away the heat transferred by the semiconductors from the plate to their opposite ends with water, or by some other heat-exchange action, we have the primary building unit of Peltier-effect thermoelectric cooling devices. Then, if we reverse the semiconductors, we get heat at the plate and we have Peltier-effect heating.

Of course, if we heat the metal plate and complete the circuit with wire and a load at the ends of the semiconductors, we obtain the opposite effect—direct energy conversion to electricity by Seeback effect—because we will set up a current in the circuit.

With these basic elements — called thermoelectric pairs — we can make refrigerators, air conditioners, heating units, and electricity generators that, compared with present equipment, are more reliable, more compact, completely silent, precisely controllable, and that operate with no moving parts.

From Britain



Fairey Engineering Ltd., Britain, recently exhibited this example of their research into the field of thermionic conversion. For the sake of demonstration and convenience, the unit uses a 200-watt electric heat source but, in practice, other non-electric heat sources would be employed. Possible uses for thermoelectric converters, envisaged by Fairey, include power for remote navigation buoys, weather stations and missile warning stations.

But where are these wondrous devices?

They are beginning to emerge from such laboratories as RCA's David Sarnoff Research Center, where in 1954 the first known thermoelectric refrigerator, a one-cubic-foot affair, was built by scientist Nils Lindenblad. He followed this with a four-cubic-foot model in 1955, and, in the same year, built the first thermoelectrically air-conditioned room.

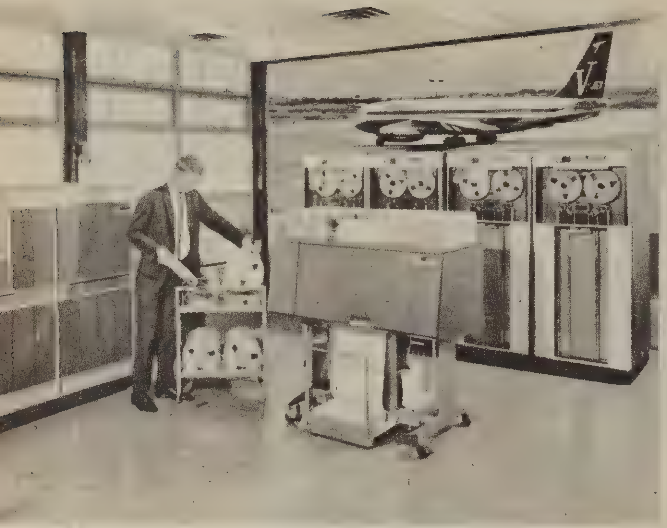
Organisations such as RCA's Applied Research are today applying these laboratory experiments to practical although specialised applications, some of which are even reaching the consumer. For instance, a large retail chain features a thermoelectric buffet bar that will cool food and drinks, and, with the flip of a switch that reverses the current through the semiconductors, will become a warmer to keep a turkey ready for the table.

However, because of the prohibitive cost for home use of this and other new technologies, practical consumer thermoelectric devices await mass production. RCA engineers explain that a basic, 17-pair thermoelectric module used in many of their applications cost today about 35 dollars. Approximately 100 of these would make a one-ton household air conditioner, and 3,500 dollars plus is a little hard on the family coffers. However, they note that mass production would quickly lower this unit cost to two dollars or less, and 200 dollars for an air conditioner that probably would last a lifetime is a good investment.

Special applications of thermoelectric devices like the nine-ton submarine air conditioner that RCA built for the Navy, highly accurate thermocouples, coolers for biological specimens, and the pioneer snack bar are making inroads on production requirements. But according to RCA's Applied Research engineers, progress is slow and no production revolution is in sight. They are quick to point out, however, that an evolution toward thermoelectric devices for our heating, cooling, and power generation is definitely under way.

New concepts, for instance, are being explored to increase the efficiency and flexibility of the technology. In the laboratory, experiments with Ettinghousen effect — thermoelectric action from a single piece of material called a "semimetal" operated in a magnetic field — are producing encouraging results. The Applied Research organisation, which has achieved cooling with Peltier effect down to minus 135 degrees F. and expects to reach minus 279 degrees F. by the end of the year by applying a magnetic field to cascaded Peltier pairs, plans to use Ettinghousen effect on top of this thermoelectric totem pole to reach a fully cryogenic minus 321 degrees F., the temperature of liquid nitrogen.

Everyone agrees that this old science with the bright new face will prove bountiful. Many envision the marriage of semiconductors and semimetals with the tremendous power of the sun's rays to turn all the earth's deserts into gardens. In any event, the technology Seebeck set in motion in 1821 now gains momentum, and its effect on our lives will be significant. (Reproduced by arrangement with "Electronic Age.")



Aviation is one industry making extensive use of computers. This installation for Qantas at Mascot, N.S.W. is part of a complex system involving spare parts and maintenance, payroll calculation, and world-wide seat booking, hotel reservation, car hire, etc.

CAREERS WITH COMPUTERS

Thinking of a career in electronics? This expanding industry offers considerable scope for the technically minded, and is no longer confined within the relatively narrow limits of communication and entertainment. This article discusses the opportunities currently offering in the computer field — one of the fastest growing industries in our society.

By Calvin Walters

THE penetration of electronic equipment into practically all phases of human endeavour has created a large range of new and attractive professions for both men and women; professions which enable them to participate in many of the world's most intriguing undertakings and projects.

This is particularly so in the field of computers. The computer industry is one of the fastest growing of all industries. It has been said that the computer will have more to do in shaping our future than any other single development for, while nuclear energy may be thought of as an extension of human muscular power, and space exploration as an extension of human locomotive ability, information processing is an extension of the power of the human brain.

RAPID GROWTH

Statistics are sometimes tiresome, but in order to illustrate the tremendous growth of the computer industry and give an indication of its importance to those who would make their career in this field, the following few figures should be very enlightening and encouraging.

In 1958 there were two computers in commercial operation in Australia. Most data processing was carried out by electro-mechanical equipment. There were 50 people actively engaged in computer work. In 1962 there were 84 computers operated by 2,000 people. In 1964 300 computers were in operation employing some 10,000 personnel.

At present Australian users have about £50,000,000 worth of computers installed. Manufacturers predict that this will be at least doubled in the next few years. The whole range of applications for computers is constantly widening so that the capacity of industry to usefully employ computers is continually increasing. These figures give some idea of how rapidly computers have come to dominate the data processing field. The demand for personnel increases daily.

The following industries presently employ Data Processing Services in Australia:

Mining

Coal
Metal

Manufacturing

Food
Printing, Publishing
Electrical Equipment
Tobacco
Wood
Textiles
Furniture
Wearing Apparel
Beverages
Paper
Machinery
Rubber
Petroleum
Leather
Chemical
Basic Metals

Public Utilities

Gas
Water
Communications
Electricity
Transport

Commerce

Wholesale Trade
Banks and Finance
Business Services
Retail Trade
Insurance
Real Estate

Government

Community Services
Social Service Accounting

Miscellaneous

Seat Reservations
Distribution Accounting
Message Switching
Personal Services
Recreation Services
Scheduling

Within any of these spheres the actual computer applications are virtually limitless but the following is a typical list:

Payroll accounting.
Inventory control.
General accounting.
Integrated stock control and billing.
Consumer billing.
Accounts receivable.
Accounts payable.
Sales analysis.
Production analysis.
TV and radio licence recording.
Freight accounting.
Statistical analysis.

The Commonwealth Public Service has installed large computer-based systems in Canberra, Sydney and Melbourne. Some have satellite units in other State capital cities. Fields of work include personnel, finance, economic and social statistics, stores supply, telephone billing, benefit payments, weather forecasting, management planning and control, and defence Service logistics. It will be seen that the scope of interest in commercial and Governmental areas is enormous.

It was my pleasure recently to spend some time with executives of IBM Australia Pty. Ltd. This firm needs no introduction to regular readers of these pages but, for the information of the newcomer, IBM manufactures all kinds of electronic computers and other business machines and has, at times, been the source of information on which I have based various articles.

During the visit I was enlightened regarding the vast expansion of the electronic computer industry, not only with respect to IBM, but with respect to almost every firm which engages in the manufacture of such equipment. The subject matter of this article will therefore almost certainly apply to all manufacturers and users of electronic business machine equipment.

Among the many interesting items furnished me in connection with computers, the following ones attracted my attention as being worthy of elaboration in order to illustrate the diverse and interesting applications of computers.

Qantas Airlines have installed at their jet base at Sydney Airport, an IBM 1401 computer in a complete data prosessing centre illustrated herewith. This equipment streamlines the control of 160,000 spare parts needed to keep the airlines' fleet of Boeing V/Jets and Lockheed Electras in the air. Many of these spares are located at airports throughout the 98,799 route miles of Qantas overseas network. All these are controlled at the Data Processing Centre at Mascot.

This computer speedily checks the 2,000 types of essential "time controlled" components; parts that have to be withdrawn after specified periods of service in the air. These individually numbered parts range from small electrical components to complete engines, and which are subjected to rigorous repair, overhaul, and checking before being allowed back into service. This computer, which can read or write information on magnetic tape at the rate of 40,000 characters a second with 556 of them on one inch of tape, is also used to analyse labour costs, prepare payrolls for its Sydney staff of 5,000 and account for fuel and oil consumed by the 24 aircraft fleet.

Qantas is also installing in Sydney one of the most advanced electronic computer centres in the world to provide complete automation of its reservations and telecommunications systems. The project will be installed in two phases. Phase one is to be completed before the end of next year. This will provide a completely automatic telecommunications switching system and a seat control system for the reservation department.

Phase two will follow. This will bring full automation to reservations. The whole system will be called Qantam. It will consist of three separate but interconnected IBM System/360 computers. One will be for telecommunication from all over the world, one for reservations and one for other routine data processing. When complete the system will enable travellers from all over the world to make bookings on any Qantas flight instantaneously and receive confirmation.

The computer handling reservations will be asked to answer questions about flights, as well as taking bookings, through remote keyboards and television display units located anywhere in the world. It will handle all the requirements of individual passengers, including hotel reservations, car hire, special diets, or the need for a bassinet. Details will be given about this remarkable system in a future article.

The registered secondary school of George Taylor and Staff Pty. Ltd., in Melbourne, has ordered a computer with which the school will offer courses in programming and tuition, by practical experience in solving problems on the computer, including how to instruct the machine using commonly used programming languages. There will be 34 listening stations and four teacher control units. The principal of the school said the scheme will contribute towards the long term solution of the pressing need for trained programmers "Good careers in data processing are available to those who know how to program, operate, and control data processing equipment" (we will deal with "programming" later).

Computers will soon be giving audible answers to those who question them. Substitute teaching assignments, up-to-date credit information, bank account balances and the latest stock prices are a few kinds of information that will soon be communicated as "spoken" replies over telephones from computers. Making this possible are new devices known as audio response units which are linked to computers.

The first commercial unit, called the 7770, was made by IBM, and is being installed throughout the U.S.A., in banks, major school systems, and departmental stores. A special version is to be part of the New York Stock Exchange's Market Data System.

The Chicago Police Department has taken a major step forward by installing a computer at its "hot desk." This is the receiving point for all calls from police officers and citizens reporting crimes. Twelve remote inquiry terminals and a large capacity disc file are linked to a computer. The terminals provide direct access into the file thus eliminating long, manual searches necessary in the past for information about criminals, suspects, or stolen cars.

There are plenty of opportunities in the computer field for men with basic technical training, initiative and personality. Here, a group of trainees is being instructed in computer techniques at the I.B.M. centre in Sydney.

When a patrolman spots a suspicious car he will radio the police communications centre a description of the car and its number. Within seconds the licence plate or vehicle number will be checked against records of car thefts previously logged in the disc file and a reply given to the patrolman.

Now for a hospital installation. At the Jefferson Medical College Hospital in Philadelphia the largest electronic system of its kind has been installed. It consists of 36 transmitting devices situated throughout the hospital and a central computer. When a patient is admitted an admission form is prepared and sent to the computer room. Here, the patients name and identification data are fed into the computer which stores it on a magnetic disc. A space is left behind the patient's name for additional information about his activities in the hospital.

The patient also receives an identification badge. Following a request for a service of some kind, such as laboratory or X-ray (or a visit by Ben Casey), the nurse on his floor takes the badge and a card identifying the service and feeds this information into one of the transmitting devices. The information is relayed to the computer room where it is automatically punched into cards. The cards are "read" into the computer which automatically prices the service, enters the information behind the patient's name on the magnetic disc and updates statistics.

Prior to discharge, patients' bills are automatically prepared by the computer at a rate comparable to typing 24 double spaced pages in one minute. The

Another I.B.M. instructional class, this time on maintenance. By its very nature, computer maintenance is normally carried out under clean and pleasant working conditions.

COMPUTERS AND DEFENCE FORCES

Use of computers is not confined to commerce and industry. The complexity of modern defences forces is such that computers are virtually a "must" at every level; from the paymaster to the functioning of its weapons on land, sea, and in the air. The armed services will need more and more computer trained personel as time goes on.

TO meet the special requirements of the services, the Burroughs organisation recently announced a compact military computer using monolithic integrated circuits.

The new general purpose system, called D84, occupies less than 1½ cubic feet, weighs 100 pounds, operates on 110 watts of power and is fully transportable, making it ideal for rugged military environments.

In announcing the new system, Walter Kerr, Burroughs General Manager in Australia, said, "The D84 extends the company's D800 series of military data processing equipment into application areas requiring compactness and extreme reliability.

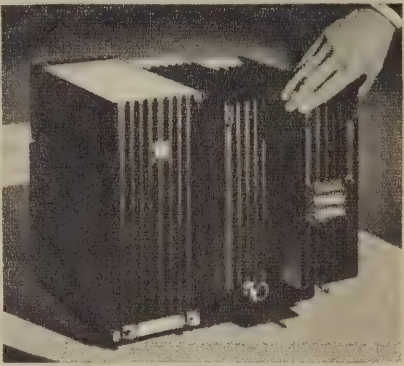
"The D84's monolithic integrated circuits are so small that it would take 30 of them to cover the top of a common aspirin tablet. In addition, life tests have shown that these tiny circuits will far outlive ordinary electronic components.

"However," he pointed out, "the key factor in the D84 is its modular design which allows it to grow—without reprogramming — to match the capacity of all but the very largest systems that have been announced to date.

"This combination of features makes the D84 ideal for tactical command and control; ground, airborne and naval data systems; fire control; automatic message processing; missile checkout, and general purpose data processing."

In the Burroughs modular concept, the basic functions of a computer system — data processing, memory and input/output control—are functionally and physically separated into individual housings. This allows a system to be tailored to exactly suit a customer's needs, and to be expanded by adding modules as his requirements increase.

As an example of the D84's growth potential, its memory can be expanded from 4,096 words to 65,536 words. For applications requiring the simultaneous, parallel processing of different computer programs, called "multiprocessing," additional data processor modules can be added.



The Burroughs D84 compact military computer.

The D84's input/output modules can handle a wide variety of peripheral devices including printers, card readers, radar and high speed communication links, typewriters, and magnetic tape, disk and drum storage devices.

The D84 was developed by the company's Defence and Space Group, headquartered at Paoli, Pennsylvania, which has been producing D800 series modular data processing systems for Army, Navy and Air Force use.

D84 systems will be ready for delivery during the third quarter of 1965.

complete detailed bill is presented to the patient at discharge. Some 3,500 requests are handled daily in the 800-bed hospital.

These items have been mentioned to give some idea of the diverse fields in which computers are used. Of course there is no need to mention their use in the accounting fields, statistical and so on. Many private and Government offices have installed computers and the demand is growing so fast that finding men and women to fill the "new professions" is a real and urgent problem.

In today's world electronic data processing equipment is essential, and not only in the fields of nuclear physics and space research. It is practically running the nation's business, both private and Governmental. Computers, electronic accounting machines and other electronic apparatus is doing the work with a fraction of the staff which would be required under the previous methods. This has not done anybody out of a job because industry and commerce were already battling to keep pace with customer demands. The computer filled a vital need.

What these machines have done is to speed up operations, and improve efficiency, thus enabling business to cope with the demands made upon it by the consumer. Rather than create unemployment it has, on the contrary, brought about a fruitful field of employment for those who like dealing with either people or machines or both together.

The most important aspect of any industry is service. It is therefore not surprising that the most important and most widely sought personnel lie in the field of customer service. These are the field engineers as they are most commonly called. The field engineer is the link between the customer who uses the computer and the firm who supplied it. He keeps the machines in the customer's office functioning at peak levels at all times.

It would be a pardonable error to assume that, because a computer is an extremely complex piece of apparatus, it is prone to all sorts of troubles. Nothing is farther from the truth. Computers are among the most reliable of electronic machines. They have to be. Currents are switched within the machine at speeds rated in "nanoseconds." A nanosecond is 10^{-9} seconds. Thus there is hardly time for an error to be discovered by human means. Errors are detected by the machine itself. Preventive maintenance therefore is one of the functions of the field engineer.

The field engineer works with the customer, planning the functions which have to be performed by the computer. He therefore meets and works with customer personnel, operators, supervisors, and executives. He must be a good "mixer" and be able to apply proper psychology in his dealings. He installs the equipment, handles customer calls to analyse machine functioning, checks all equipment periodically, installs new devices and makes changes in machine capacity to meet customers' changing requirements.

The field engineer assists the engineering and manufacturing organisation in field tests of new equipment and refinement of products, suggesting possible improvements for better machine performance or improved field engineering methods. What qualifications then must a person have to fulfil the requirements demanded for the job of field engineer?

One does not have to be a mathematical or electronics genius to qualify. First essential is a high degree of mechanical interest and aptitude. Then a reasonable theoretical knowledge of electricity and electronics. Typical candidates would have at least two years' formal training in these fields, either at a technical college, military electronics school, or in industry. A good candidate is one who for some minor reason was unable to complete a university or technical college diploma course.

Former telephone technicians find employment as field engineers. One field engineer in a well-known company was a former bank clerk. Character, personality and appearance are important. Technical proficiency must be supplemented by the ability to meet and work with people. Once a suitable candidate is accepted by the computer firm, internal staff training does the rest. Study overseas, with all expenses paid, is a further attraction. Taking everything into consideration the qualifications for field engineers are not unduly severe and well within the scope of many people.

Working in close collaboration with the field engineer is the programer. This is a career for which men and women are developing intense enthusiasm. It has a dramatic impact on women who have special qualities to handle detail of the nature required in this work. The programer is the human link between the computer and the work it is required to do. He or she is the source of the original logic which is stored in the computer "memory" to tell it what to do.

The programer works with the customer to determine exactly which of his operations can be more efficiently handled by a computer. The art of the programer is then, to analyse and break down the problem into a logical sequence of elementary steps. He then translates these into computer language. No knowledge of how a computer actual-

(Continued on Page 101)

THE LUX SQ11 — SOLID STATE STEREO AMPLIFIER

This is one of the most popular stereo amplifiers ever available in Australia; users in every State report outstanding results. Input sensitivity is 4mV, output is 20 watts in each channel. Features include scratch and rumble filters, loudness control, separate bass and treble controls etc. If in Melbourne hear this fine amplifier at the new sound auditorium, 431 Bridge Road, Richmond. Worth twice this price .. **£69/10**

REVOX TAPE RECORDERS

Swiss REVOX tape recorders are now in stock—these units are used extensively by broadcasting stations overseas and in Australia. Write to us for a price—manufacturer's agreements will not permit us to advertise our prices! The REVOX Model G36 is the most advanced unit in its class.

KEF SPEAKERS

Complete stocks of KEF speakers will arrive at Encel Electronics shortly. This shipment includes the new model "Celeste" with the new KEF super-tweeter — which offers improved high frequency performance. Ask for our KEF prices—just specify the model of interest to you and we will quote promptly!

★ UNIQUE ENCEL STEREO SYSTEM WITH 5 SPEAKER ENCLOSURES

Here's an opportunity to purchase a complete stereo system—at a remarkably low price! This system comprises the Star SA-30 bookshelf stereo amplifier with 10 watts RMS output in each channel (or 20 watts peak). Dual 1010 changer complete with cartridge, two "Encel-ette" 5 speaker systems with oiled walnut or teak cabinets . . . (each speaker system has four 6½in speakers and one 2½in tweeter and the price is only **£95**

The new model Encel X1212 stereo amplifier may be substituted without additional cost. (See details on this page).

LEAK "STEREO 30"

Trade-in valuations on your old equipment have never been better—and now is the time to purchase your new Leak "Stereo 30" solid state stereo amplifier. Fully transistorised equipment is smaller, lighter, creates no heat problems **and** is more reliable so write for a quote **now!**

SPEEDY QUOTE SERVICE

Our mail order department procedure has now been streamlined—and your quote for any equipment will be posted to you without delay. If the equipment you wish to buy is not listed on this page, just write to us for your price!

OCTOBER CONNOISSEURS' OPPORTUNITY

Now and again we have price-crushing offers to make . . . this month we offer a brand new LEAK "Stereo 30" solid state amplifier **and** two new KEF "Celeste" speaker systems, incorporating the new model KEF tweeter. Price **£190**

TRUVOX STEREO SYSTEM

Truvox full transistorised stereo amplifier, Labcraft 605L transcription turntable, All-Balance tone arm, ADC 770 cartridge, two 12in Wharfedale RS/DD speakers. All brand new and guaranteed. **£165**

KELLY SPEAKERS

Illustrated is the Kelly Mk 111 12in bass speaker . . . a bass unit which enjoys a fine reputation with hi-fi enthusiasts. Encel Electronics are Australian Distributors of Kelly speakers . . . our price for the Mk III is only **£19/10/-**

When used with the Mk II Kelly Ribbon Tweeter, the standard of reproduction cannot be equalled — the tweeter is the most effective domestic treble reproducer ever designed, regardless of price. Encel price is only .. . **£19/10/-**

(Previously sold in Aust. for £35/10/!) Kelly Crossover Network **£4/10/**

Celestion

Celestion speakers are internationally acclaimed and are used by professional studios all over the world. Both models feature co-axial treble and bass units with electrical crossovers at 4 kc/s. These advanced speakers are worthy of the most effective high fidelity amplifying system. Read the reviews in the April "Gramophone" (P 511) and June "Hi-Fi News" (P. 73).

The Standard Model CX-1512 is rated at 15 watts RMS **£19/10/-**

The DeLuxe Model CX2012 is rated at 20 watts RMS **£29/10/-**

THE NEW CELESTION "DITTON 10"

Without doubt, this compact (12¾in x 6¾in x 8¼in) speaker system is the most advanced 10 watt high fidelity speaker system available in the world. Frequency response is 35-15,000 c/s. Available in Walnut and Teak finishes. See review, page 41, June "Gramophone."

£29/10/-

THE NEW ENCEL X1212 STEREO AMPLIFIER

A completely new X1212 Encel amplifier is now available—with new features including design and performance. Many hundreds of the previous model were sold—now the X1212 is better than ever! 12 watts output each channel, 30-20,000 c/s frequency response, input sens 4 mV. Although the specifications have been improved the price is still .. **£44/10**

TAPE RECORDERS

Stock now includes: Akai M8, 707, X4 and ST1, Tandberg 74B and 64, Philips EL 3548, EL 3300, EL 3549, National 703S, 705, 755S, Sony 200, 357/4, 500A, Geloso, Grundig, Ferguson, Brenell, Truvox, Revox etc. Select the model you require and ask for the Encel price **before** making your investment. It will pay you well to do so! N.B.: Ask for a price on models not listed.

EARLY ENCEL SPECIALS STILL AVAILABLE

The Special offers made from time to time by Encel Electronics in "Electronics Australia" (Page 15) are kept open for several months. In the majority of cases, the prices quoted are still applicable. Please check with us!

NOW IN STOCK

Amplifiers

Leak, Pioneer, Lux, Encel, Trio, Truvox, etc.

Turntables

Orpheus, Labcraft, J.H., Lenco, Garrard, Thorens, Dual, etc.

Speakers

Wharfedale, Kelly, Akai, Celestion, Goodmans, Richard Allen, Stentorian, Leak, Pioneer, KEF, etc.

Pick-Ups and Cartridges

Ortofon, ADC, Decca, SME, Pritchard, J.H., All Balance, Shure, etc

Tape Recorders

Revox, Tandberg, Grundig, Akai, Sony, National, Brenell, Geloso, Ferguson, Truvox, etc.

Dictating Machines

Stenorette, Philips.

TRANSISTOR RADIOS

A.W.A., H.M.V., Philips, Sony, Crown, National Astor, etc.

EXCLUSIVE OFFERS FOR OCTOBER!

1 Labcraft 605 turntable, Pritchard tone arm, ADC stereo diamond cartridge .. **£39/15/-**

(If you prefer an Orpheus Silex turntable to the 605, add £8).

2 Pioneer SMB 161 stereo amplifier with AM/AM/SW tuners, Labcraft 643 turntable, B and O stereo diamond magnetic cartridge, two 8in Wharfedale speakers . **£89**

(With the Labcraft 605 turntable, All Balance tone arm and ADC 770 Cartridge, **£99/10/**)

3 Pioneer 204B stereophonic amplifier, with AM/AM SW tuners . . . two Celestion 12in CX1512 co-axial wide - range speakers **£109/15**

(Ask for a price with any other speakers of your choice!)

4 The proven Star SA30 **OR** the new Encel X1212 stereo amplifier, Labcraft 605 turntable, J.H. tone arm, ADC 770 stereo diamond cartridge, two twin cone 10in Wharfedale RS/DD speakers or Richmond Allen 10in speakers . . . **£94/10**

(Retail £132)

5 Leak "Stereo 30" solid state stereo amplifier, two Goodmans "Triaxiom" 212 wide-range speakers **£159/10**

(Ask for a price with any other speakers of your choice).

6 Labcraft turntable with stereo diamond cartridge, two Wharfedale 8in RS/DD speakers **£24**

(Bargain of the month!)

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HIGH GAIN LOW NOISE SILICON PLANAR TRANSISTORS

We are further expanding our line of high quality, Australian made semiconductors. We have added five new transistors this month. Fairchild provides you with the widest possible selection of reliable silicon Planar devices at prices competitive with germanium. Look to Fairchild Australia for all your semiconductor requirements. Write us for complete data or phone 26-3713 South Yarra, Victoria; or 43-1537, Sydney.

New from Fairchild Australia for October
Ex Stock

TRANSISTOR	h_{FE} (Typ.)	NOISE FIGURE (Typ.)	PRICE* 1-99	PRICE* 100-999
NPN TRANSISTORS				
SE 4010	350 @ 1mA 100 @ 50μA	1.5db @ 30μA	15/-	10/-
2N 2484	450 @ 1mA 375 @ 100μA	1.8db @ 10μA	60/-	40/-
PNP TRANSISTORS				
AY 1110	300 @ 1mA 100 @ 50μA	1.5db @ 50μA	16/-	11/-
2N 3502	270 @ 10mA 180 @ 100μA	1.0db @ 30μA	75/-	50/-
FT 0019M	180 @ 10mA 140 @ 10μA	1.0db @ 20μA	120/-	80/-

*Plus 25% sales tax if applicable

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ELECTRONIC ROUNDUP

A wide variety of electronic stories reach our office each month, each emphasising the rapid penetration of the science into all phases of our daily life. Here is a selection of smaller items illustrating a wide diversity of current applications.

NEWSPAPER SETTING BY COMPUTER: Newspaper type-setting using a central computer is now practical with a system developed by Elliott-Automation Computers Ltd., Elstree Way, Boreham Wood, Herts, England. It makes its commercial debut in setting a new British daily newspaper, the "Reading Evening Post." The system uses a standard Elliot 803B computer with a range of special peripheral equipment, including Invac keyboards, printers and tape punches.

The computer is programmed to remember type faces and sizes, to store copy for possible corrections, justify lines, hyphenate words, handle tabulated material, etc. If asked to do something for which it is not programmed, the computer operates a red light on the particular compositor's keyboard.

The "Computer-set" type-setting equipment undergoing commissioning tests. Note the print - out device on the typesetter's left.

Twelve compositors can use the computer simultaneously for the preparation of copy, each having a keyboard with 64 keys to provide instructions on such things as format, type size, line length, etc., followed by the copy to be set. The computer prepares the copy according to instructions and displays the result on a print-out device alongside each compositor. From the print-out, both compositors and proof readers can check that the text is correct and, if not, instruct the computer to make the necessary corrections.

At the same time as the compositors receive the print-out copy, a paper tape bearing the instructions for type-setting is produced and updated when corrections are made. The equipment has been demonstrated feeding its printing instructions to a Photon type-setter in the United States via a trans-Atlantic link, but the method of operation is equally applicable to hot metal and other type-setting machines.

With the "Evening Post," taped instructions operate a photo-setter which provides positive type image on white paper. This is pasted on a page layout, the pages photographed and page-size film negatives obtained. These are used to produce plates from which the paper is ultimately printed.

It is claimed that the new equipment will cost less than conventional equipment for the same order of output, with lower operating costs into the bargain.

SORTING WITH X-RAYS: An X-ray sensing device coupled with a fast sorting mechanism has brought automation to the separation of potatoes from stones and clods unearthed by a harvester. The automatic potato harvester has been developed by W. J. West and co-workers at the Scottish station of the National Institute of Agricultural Engineering, Penicuik, Midlothian. Until now purely mechanical means of separation have proved either unreliable or unduly damaging to the potatoes.

The sorter relies on the fact that low energy X-rays are attenuated more severly by stones and clods than by potatoes. The mixture discharged from the harvester's conveyer drops through horizontal beams of X-rays, spaced one inch apart. Detectors opposite each beam are connected to trigger circuits that control pneumatically operated sorting fingers **(see picture).**

The trigger circuits are set to operate for stones and clods but not for potatoes. The timing of the trigger is arranged so that the sorting fingers move aside to allow stones and clods to fall to the ground, but remain in position for potatoes, deflecting them to a second conveyer. The experimental machine incorporates a separator with 23 fingers, each of which can operate up to eight times a second. In recent field trials this unit recognised and sorted at least 95 per cent of the potatoes harvested. Commercial prototypes are now being built.

Clearly the technique holds promise for a much wider range of sorting problems: for instance, the National Coal Board is considering it for separating impurities from coal.—**"Science Journal."**

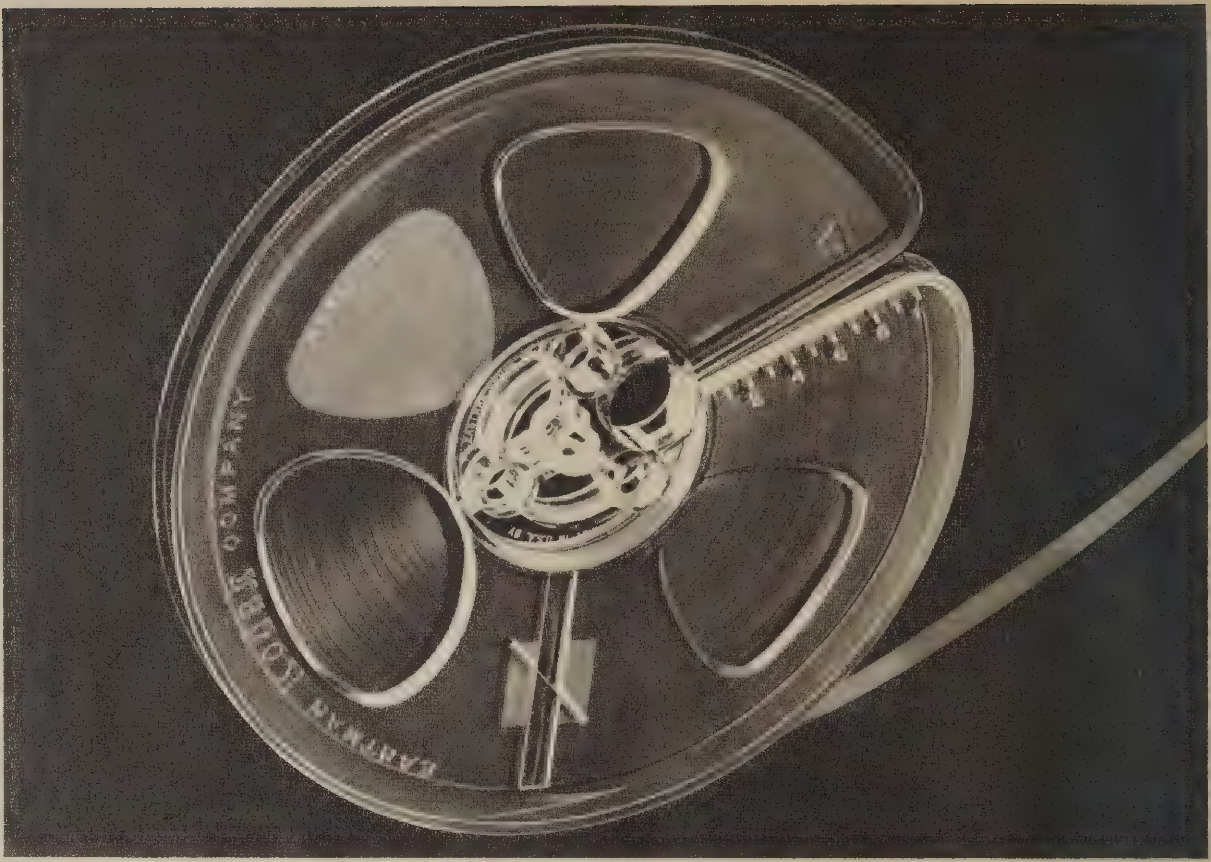
Automatic sorting device which discriminates between potatoes, stones, and clods of earth.

LOCAL GOVERNMENT COMPUTER CENTRE: A co-operative venture, unique in local government in Britain, has enabled each of six boroughs in south-east London to have the use of a large computer, the cost of which could not be justified economically by any individual borough.

The boroughs concerned—Bermondsey, Camberwell, Deptford, Greenwich, Southwark and Woolwich — recently opened a computer centre at John Humphries House, Stockwell Street, Greenwich, where the rating records for 300,000 properties will be produced and the pay for 15,000 people calculated. The centre houses a LEO III, costing £250,000, which will operate 24 hours a day for five days a week and whenever it is needed at weekends.

The LEO III has three divisions of magnetic core store which holds a maximum of 24,576 program instructions or 122,880 numeric characters. It has six magnetic tape units with transfer rates of 28,000 characters per second. Input is by way of magnetic tape, a 1,000 characters-per-second paper tape reader, or a punched card reader operating at 400 cards per minute. Output is by way of the magnetic tape, a 1,000 lines-per-minute printer, paper tape at 110 characters per second, or punched cards.

In addition to processing the boroughs' work, the computer handles jobs for other organisations, and its maker uses it as part of its London bureau service. Several non-financial jobs are also being done, including the production of library catalogues, critical path analysis for building projects, and the calculation and printing of bills of quantity. A fully integrated accounting system for Deptford is already processed by the computer. This includes stores control, transport costing, and payment of creditors. The system has been designed so that it may be used by any local authority in Britain or abroad.



KODAK TAPE

...shines in more ways than one

The satin smoothness of Kodak Sound Recording Tape's surface translates into brilliant sound reproduction. It's all in the way the tape is made — and who makes it. Making sound tape is remarkably like making film. Both involve coating microscopically thin emulsion on a base. And who knows more about emulsion coating than Kodak? When our film scientists set out to create a superior tape, they had all these advantages to build on.

They developed the "R-type" binder, which can be coated to a smoothness unequalled by any other kind. You get a remarkably durable, low-friction surface, minimizing oxide build-up on recorder heads, as well as suppressing noise.

To cut friction still more, we use a special lubricant both in the magnetic layer and on the base.

This double dose has several desirable effects: the tape glides freely over recorder heads, prolonging their life; there's no slippage over capstans, so constant speed is assured; the lubricant is chemically stable — it does not smear on your equipment.

Kodak Sound Recording Tape comes in many types and sizes to meet all standard recording objectives. Let your Kodak dealer show you the range.

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Kodak

The computer programs are run each week so that by Wednesday there is a complete analysis of all the council's expenditure up to the preceding Sunday. This includes future commitments—bills received but not yet paid—so that the council has a realistic picture of its financial state.

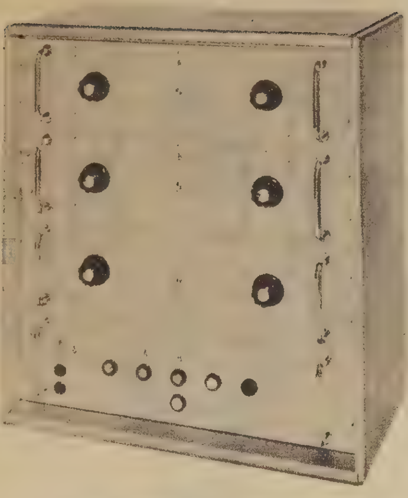
This outstanding system is being developed to include analysis of income and the preparation and printing of final accounts. The system of rates billing and accounting will then form part of the whole operation. To cope with this additional work, extra equipment, comprising a further magnetic tape unit and a second high-speed printer, costing about £40,000 is being added to the computer.

The joint committee running the centre has a staff of 50 to operate it at a gross annual cost of £135,500. Another £44,500 is added for system analysis and programming services, making £180,000 in all. By selling time which is at present surplus to its own requirements to outside customers, the joint committee receives an income of £50,000 per annum, leaving a net cost of £130,000 to be shared by the six boroughs in proportion to their ratable values. Woolwich, with a ratable value of £8,100,000, pays the most, Deptford, with £2,800,000 the least.

COMPONENT GRADER: British Physical Laboratories Ltd., of Radlett, Hertfordshire, U.K., have introduced a multi-channel component grader (CZMU 457) which enables a component to be sorted into any one of three preset limits in a single operation. Standard equipment has, until now, enabled resistors, capacitors, or inductors to be tested to a single tolerance only, leaving the manufacturer with problems. He has to supply products to various tolerances, as these determine the selling price.

The new instrument is an extension of the company's single-channel component grader, consisting of comparator, automator, and standard (inductor, resistor, or capacitor) and, although the standard design is for three tolerances, it can be supplied with a larger number of channels. It can be operated up to 6,000 tests an hour, which is effectively 18,000 per hour compared with the single channel equipment. It is also suitable for integration into automated lines.

Information given by the final display of indicator lamps, designed for easy understanding by an unskilled worker, is: (a) that the component falls within one of the three pre-selected tolerances, these tolerance groups being between ±0.2 per cent to ±60 per cent of the standard's value; (b) that the component value is above the three tolerances selected; (c) that the component is below the three tolerances selected; and (d) that the component is open circuit or is not making proper contact with the comparator's terminals.

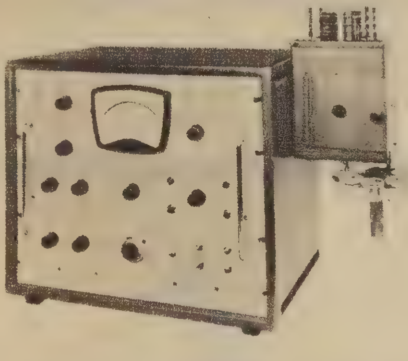


A multi-channel high-speed component grader designed for classification of resistors, capacitors or inductors.

FLAME PHOTOMETER: Southern Analytical Limited of Camberley, Surrey, England, have developed a flame photometer which compensates automatically for background from the spectral emission of the flame itself, thus extending the range of the technique.

Light from the flame passes through a relatively wide band filter centred on the required wave-length. A beam splitter diverts some of the light to the "background" photomultiplier and the remainder passes through a narrow band filter to the "line" photomultiplier. Photomultiplier outputs are integrated, and applied differentially to the output meter; the relative sensitivities of the two detector systems are arranged so that the difference corresponds to the emission from the line only. Output from either photomultiplier can be displayed alone, and integration of the flame emission gives steady readings.

The burner uses a high temperature flame, and will handle oxy-hydrogen, oxy-propane and other gas mixtures. A direct injection atomiser is coupled with premixing of fuel and primary oxygen supplies. This gives efficient atomisation with low retention times and memory effects, while keeping burner noise at a reasonably low level; it will also accept organic solvents. Detection limits of 0.0002 ppm Li and 0.003 ppm Ca can be obtained: Ca can be determined directly in diluted serum.



This flame photometer uses two photomultipliers in a comparison circuit to compensate for background from spectral emission of the flame.

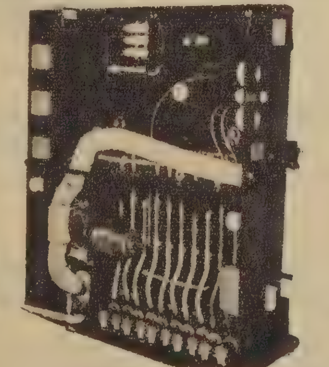
PORTABLE ELECTROCARDIOGRAPH: The "Cardette" portable electrocardiograph is marketed by Newmark Instruments Limited of 143/9 Great Portland Street, London W.1., England. In addition to normal use, it is now being found that this has great possibilities for use by veterinary surgeons.

It was the first medical electronic device from this company, and transistorised circuitry was used throughout. Veterinary purposes for which it has been used have been examination of racehorses after suspected drugging, examination of cats and dogs for heart conditions, and even in Central Africa for examining a crocodile. In racehorses it has been found that some drugs affect their heart action, and that this instrument can give an immediate indication.

Dimensions are 9in x 5¾in x 3½in and weight is only 8lbs. It can be recharged overnight from any A.C. mains source, or from a 12 volt vehicle battery.

A portable electrocardiograph originally designed for conventional medical use, but which has since found application in veterinary science.

FAST FILM PROCESSING: Photographic film or paper up to 9½in can be processed at speeds up to 50ft per minute with a machine developed and now being made by Elliott-Automation's Airborne Display Division of Lower Sydneham, London S.E. 26, England. It was originally designed for the British Ministry of Aviation for high-speed processing of reconnaissance or aerial survey film. It is also suitable for processing seismographic or recording paper if used in considerable lengths. The spools are for film in lengths of 1,000ft. The new processor will be known as the Elliott Continuous Photo Processing Machine (type 12). It can be used in full daylight and in all climatic conditions.



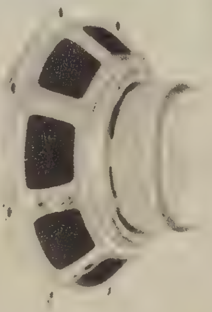
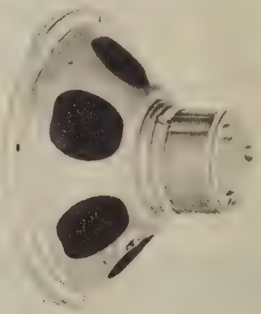
A high-speed photographic processer capable of handling either film or paper in 1000ft lengths.

X-RAY ANALYSIS SERVICE: By using the new Elliot multi-fixed channel X-ray spectrometer, Elliot-Automation's Metals and Mineral division of Blackwall Lane, Greenwich, London, England, is able to set up the most comprehensive X-ray analysis facilities yet available in Europe. The new spectrometer, Type XZ1070 is of modular construction, enabling it to be used "on stream" in many industries, from minerals to cement making, and from oil processing to fertilisers, including the most rigorous environments. It is particularly suitable for on-line use in mining and similar applications.

In spite of the abrasive effects of most slurries, a Mylar flow cell window only 6 microns thick has been used over long analytical periods. ■

MASTER RANGE

Philips Hi-Fidelity loudspeakers

		
"MINUETTE" 6.5" "MINUETTE" (AD3701PM) TWIN CONE Diameter: 6½" Rated Output: 10 watts in specified enclosure Voice Coil Impedance: 15 ohms. Frequency Response: 45 c.p.s.–19 Kc/s. Price: £7/10/- ($15.00)	**"MINSTREL" 8.5"** "MINSTREL" (9170PM) TWIN CONE Diameter: 8½" Rated Output: 10 watts. Voice Coil Impedance: 15 ohms. Frequency Response: 40 c.p.s.–19 Kc/s. Price: £10/10/- ($21.00)	**"MAJESTIC" 12"** "MAJESTIC" (A.D.5200PM) TWIN CONE Diameter: 12" Rated Output: 20 watts. Voice Coil Impedance: 15 ohms. Frequency Response: 35 c.p.s.–17 Kc/s. Price: £30/-/- ($60.00)

Philips Twin Cone Master Range Loudspeakers have been developed in the laboratories of one of the largest Electronic Companies in the World. Speaker efficiencies are of the highest order (up to 14% in AD5200PM) and full details of a versatile range of matched enclosures are available- and *Philips Master Range Loudspeakers are available at most attractive prices.*

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PHE4270

Technical Review

EXPERIMENTS PROBE EXISTENCE OF HUMAN SONAR

Although we have been astonished by the ability of certain animals in using sound echoes for hunting and for finding their way around, it turns out that human beings have a similar, if less developed, faculty.

by Nigel Calder

THE California sea-lion can locate small pieces of fish in a tank in darkness, just as rapidly as it does in daylight, and can tell the difference between fish and horsemeat without picking it up. Thomas C. Poulter of the Stanford Research Institute has investigated how it does so by a "sonar" system, sending out a series of short "pings" and interpreting the echoes.

These studies are but one example of the discovery of sonar systems in animals — the most celebrated users being, of course, bats and dolphins. It is not a faculty that one would associate with human beings. And yet we learn that man is indeed capable of using sonar without the aid of any special equipment.

TYPICAL EXPERIMENTS

A blind man sitting in a quiet room a few feet away from a disc a few inches in diameter can tell when the disc is exchanged for one only about 10 per cent larger in area. He does so by clicking his tongue, hissing or even speaking a word, and listening to the echo. Charles E. Rice and Stephen H. Feinstein have established this measure of the "echo-acuity of the blind" in experiments with four blind subjects at the Stanford Research Institute.

The ability of the blind to "sense" the presence of objects in their vicinity — and the very tap-tap of the blind man's stick which helps him to find his way about — have been familiar for a very long time. In spite of these hints, modern science seems hitherto to have neglected these innate senses and has tended, in its attempts to develop aids, to think in terms of electronic detectors designed to be carried by the blind.

It may be that, in the end, devices that generate or detect signals will turn out to be the best answer; meanwhile, however, there is plainly a great deal of value in exploring the talents of the unaided man, with a view to seeing whether they can be developed by training. The work at Stanford Research Institute is supported by a grant from the U.S. National Institute of Neurological Diseases and Blindness.

In these experiments, which were reported in "Science" (Vol. 148, p. 1107), the four subjects were men between 20 and 30 years old, all of whom had been blind for at least five years but had normal hearing. In training, they learned to make a sound of their own choosing for echo detection. The room in which they were tested was quiet but not acoustically "dead." They sat in an accurately positioned chair and the target discs were lowered by the experimenters through a trap-door in the ceiling (see drawing). For the four subjects, in repeated tests at distances ranging from two to four feet, the minimum increase in area of the target that they could correctly judge as "larger" ranged from 7 to 23 per cent.

These figures are computed from the statistics of the errors made, not from direct tests with targets of all sizes. For three of the four individuals, there was little diffierence in performance as their distance from the targets changed.

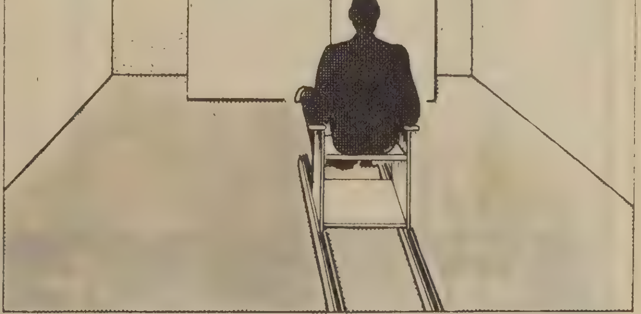
A man using his sonar does not know what he is listening for in order to make his comparison; the trick is done by some unconscious mechanism of hearing which, nevertheless, leads to a conscious evaluation of the situation. Rice and Feinstein think that, in this area-judging test, the ear is probably detecting variations in the intensity of the echo.

These experiments are part of a continuing program at the Stanford Research Institute, the purpose of which is to explore, with rather precise experimental metods, the possibilities and limitations of human sonar. For example, there are tests in which the target is moved an inch or two forward or back, to see if the human sonar can detect such movements. In further tests, targets of different shapes — squares and triangles, for example, in place of discs — are presented, not so much in the hope that the shapes will be identified, as that the fact that there is a difference will be apparent to the subjects even when there is no change in area.

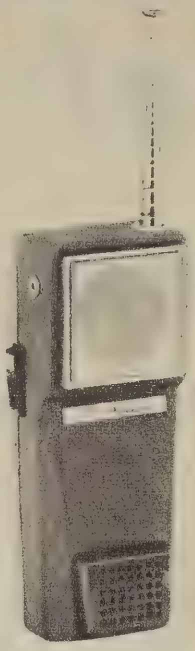
Another aim is to discover what is the smallest detectable target. Again, there are experiments with targets of different materials to see whether the subject can distinguish between, say, denim and velvet. At the same time, high-fidelity electronic recording of the echoes may provide the experimenters with clues as to the small, unobvious differences that the ear is noticing.

The experimenters centre on blind subjects (who are brought out from San Francisco to the laboratory at Menlo Park, and paid for their trouble), but it seems that sighted people can, with experience, show similar proficiency in sonar—although the incentive to develop this faculty is not so strong.

There are a large number of blind people in all countries who may be eager to see this human sonar, which is just a "feeling" they have, codified, explained and developed. Possibly, men can learn to interpret echoes from an acoustic source with a much higher pulse-repetition rate, like that of animals. But it is in any case interesting to know that we have this ability, which we have admired in other species, even if it is one that we have neglected. ("New Scientist" Vol. 26 No. 449.) ▬



The set-up in the "quiet room" used to test blind subjects for a "sonar sense." The subject attempts to detect a change in size or position of the disc.



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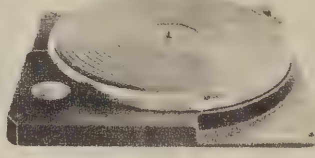

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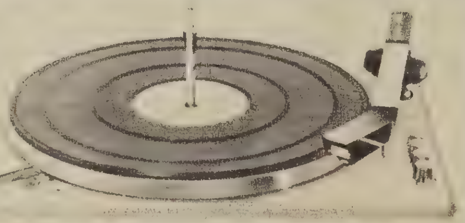

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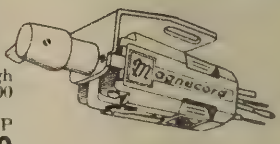

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MIDGET POWER PACK DELIVERS HUNDREDS OF AMPS

An intriguing line of current scientific research is the production of extremely powerful magnetic fields, using "super-conductors" to make "super-magnets". A recent development in this field enables extremely high magnet currents to be obtained from a small power supply.

A MAJOR obstacle to the construction of "super-magnets" with fields of 100,000 gauss and above was overcome recently when General Electric demonstrated a unique power supply for producing large circulating currents in such superconducting magnetic coils.

Superconductors are materials that, at temperatures close to absolute zero, offer no resistance to the passage of an electric current. Using certain of these materials, scientists have been able to construct electromagnets that have produced record-setting fields of up to 101,000 gauss. This magnetic field is 200,000 times stronger than the earth's, and there is promise of higher fields to come.

The experimental coils in such magnets have been wound from superconducting wire and powered by a few hundred amperes of direct current. To produce higher fields, these and larger coils, with even heavier superconducting wire, require currents ranging up to thousands of amperes. Using earlier techniques, these currents would have had to have been fed into the coil through thick conductors of ordinary wire, creating a tremendous "heat leak" into the low-temperature environment in which superconductors operate.

This "heat leak" problem has been solved by the new General Electric power supply, which operates without moving parts in the super-cold region and can convert a small input of alternating current into a large output of direct current. The modest a-c input is fed through a thin conductor. Conversion to a large d-c output then takes place at a temperature of 4.2 degrees Kelvin (about 452 degrees Fahrenheit below zero). This is a significant feature of the new power supply, since ordinary rectifiers — the devices commonly used to convert AC into DC — do not function at such low temperatures.

The new device, called an "electric flux pump," was invented by Dr Theodor Buchhold, a Senior Engineer working at both the Research Laboratory and the Advanced Technology Laboratories.

In experiments with a laboratory model of the new power supply, an a-c input of less than one ampere was converted into a d-c output of about 500 amperes—about twice as many amperes as were required for the record field of 101,000 gauss attained in 1963 by a superconducting coil constructed at the Research Laboratory.

Ultimately, the new device — which can fit into a space the size of a man's fist — should be able to generate several thousand amperes. To produce similar amounts of current, a conventional d-c power source would have to be the size of an office desk or larger.

The new d-c power supply takes advantage of the fact that once a current is started in a superconducting coil, it will continue to flow indefinitely. The current in the coil can be built up gradually in a series of steps, and because of the analogy with ordinary pumping processes, such a d-c generator can be called a "flux pump."

The General Electric flux pump operates completely electrically, making it faster and more efficient than other — mostly mechanical—solutions that have been described in scientific literature.

In addition to its present application to high field magnetic coils, the electric flux pump is expected to prove valuable as a source of high currents for other experimental purposes.

"Research Laboratory Bulletin," General Electric Co., Winter 1964-65.

Dr Buchhold lifts a superconducting coil and flux pump from a container of liquid helium. The flux pump is near the inventor's right hand.

COMPUTER IN THE SUPERMARKET

Britain's first automated supermarket opened its doors in Wallasey recently with the introduction of "punched-card shopping" at one of the stores of Thomas Scott and Sons (Bakers) Pty. Ltd.

The principle of the scheme is that the supermarket need display only one sample of every article stocked — in this instance, a range of 3,000 products. Under each item is a special pocket with a batch of punched cards. Customers pick up one or more cards from below the article chosen and do not need one of the wire baskets that hallmark the new grocery stores of today.

When a shopper has collected all the punched cards corresponding to her purchases, she presents them to the checkout desk. Here a tabulator prints out a bill—complete with a tear-off slip —showing the total to be paid.

The bill is passed to the stock room, where the order is packed. The customer is given the tearoff slip from which she first pays her bill and then uses it to identify her purchase, already packed in a carrier bag.

The system, which has been installed by De La Rue Bull Machines Ltd., is similar to one introduced by a French shopkeeper in Caen.

There, 2,000 articles are displayed in a selling area of 500 square feet which, in a self-service store run on traditional lines, would accommodate only 600 articles. Monthly turnover at Caen has increased 3½ times in 18 months, and the cost of the punched-card installation represents only 1 per cent of turnover.

Savings expected at Scotts, part of Associated British Foods, are largely based on experience from France. Main advantages are savings in shop floor and shelf space; elimination of pilfering; an itemised bill of purchase; and an automatic accumulation of information for sales analysis and re-ordering.

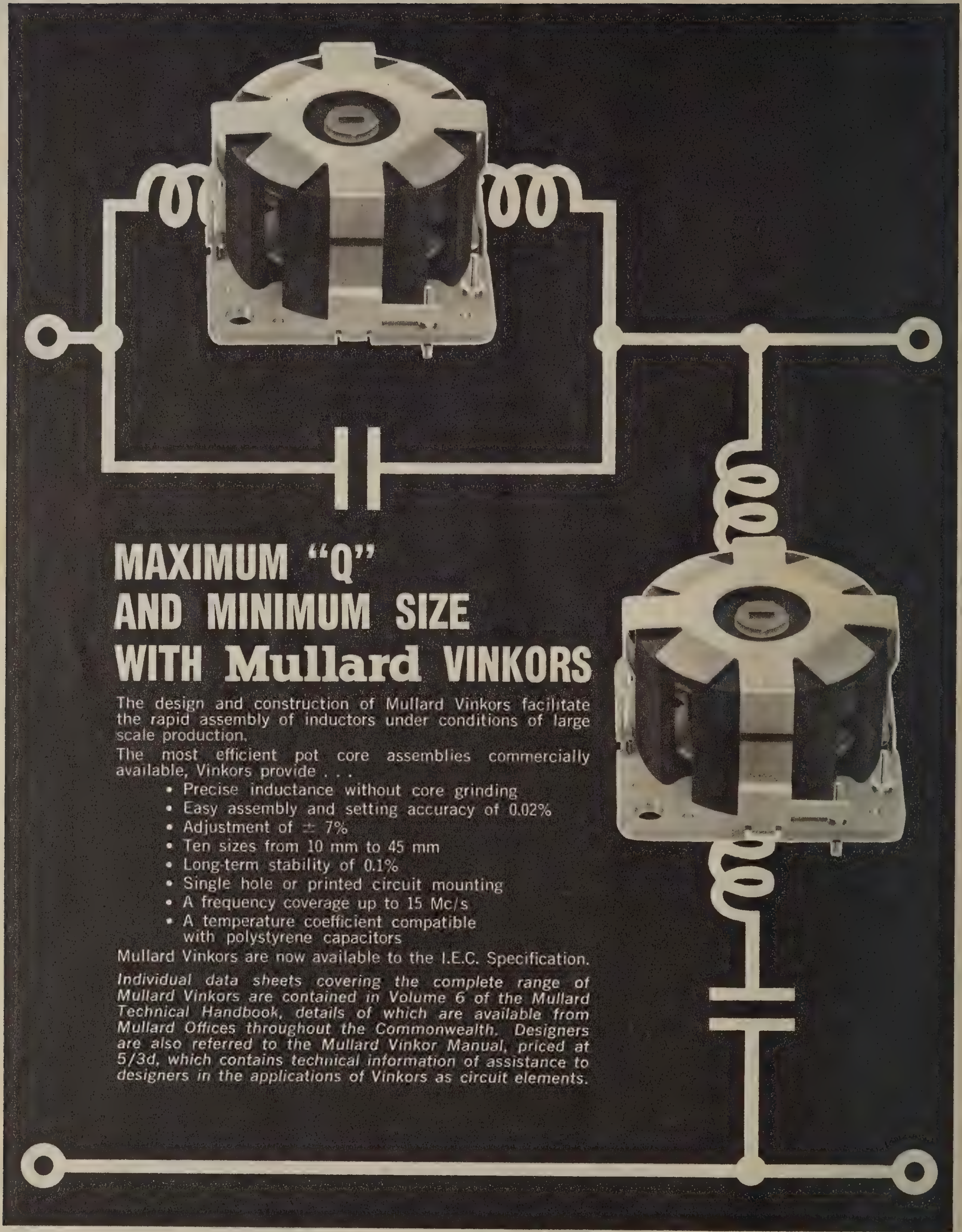
In 1,000 square feet a range of commodities are displayed that would need more than twice this amount of space for conventional merchandising. The forecast weekly turnover is around £5,000.

Avoidance of losses through pilfering, which may be as high as 2 per cent of turnover, and of inaccuracies at checkout points, more than offset the £150 a month rental for the tabulating machinery.

But a director of the company, Mr William Scott, said that it will be a month before the firm, which includes 70 other supermarkets among its 300 shops in Merseyside, can assess the economics of the project.

—("Electronics Weekly," 14/7/65)

No trollies, no lifting — just a card. Time taken to invoice and package the goods ready for the customer averages three minutes.



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Individual data sheets covering the complete range of Mullard Vinkors are contained in Volume 6 of the Mullard Technical Handbook, details of which are available from Mullard Offices throughout the Commonwealth. Designers are also referred to the Mullard Vinkor Manual, priced at 5/3d, which contains technical information of assistance to designers in the applications of Vinkors as circuit elements.

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SCIENTIFIC AND INDUSTRIAL NEWS

Ultrasonic Tester

A new instrument for the non-destructive testing of heterogeneous materials such as concrete, fibrous structures like wood or asbestos and a number of other products including flaky and large-crystal substances is based on the use of comparatively low ultrasonic frequencies.

The instrument is used by comparing the time needed for a pulse of ultrasonics to pass through a specimen of known properties with that required for the material under test.

A typical application is the quality control of placed or precast concrete and examination of its deterioration by frost action. Porosity and discontinuity in rock or graphite may also be examined and uniformity in graphite electrodes can be tested with this instrument.

The speed of an ultrasonic wave is influenced by the anisotrpy of a material, that is the degree to which its structure along one axis differs from that along another. Variations in timber grain can be measured. Bonding defects in laminated structures can be pin-pointed and the unit has been used successfully to determine the extent of insect attack on the beams of old buildings.

The device used barium titanate transducers to produce the ultrasonic pulses which can be of 60,000, 100,000 or 150,000 cycles per second; the more open the structure of the material under test, the lower the frequency applied.

Makers are M. Falk and Co., Emefco House, Bell Street, Reigate, Surrey.

Solid-state Relay

A power master relay has been developed which is thought to be of a radical nature. It is a completely sealed unit capable of controlling alternating-current power loads, solenoids, valves, contactors and motors direct from standard direct-current supplies and low-current transistor circuitry.

The relay is compact, fully transistorised, and has no moving parts. It is a plug-in device, requires no maintenance, and is said to have a life of up to 1,000,000,000 operations at full rating. It is unaffected by vibration or shock and will operate without noise or magnetic radiation at a speed claimed by the manufacturer to be 20 times faster than conventional relays. The unit should find applications in high-speed switching systems and could be of particular interest to designers of computers and transistor circuitry.

The power master relay has a semi-conductor output contact which is capable of switching alternating-current loads with continuous ratings of up to three amperes at 270 volts inductive. It is available in three standard operating voltages of 12, 24, and 50 volts and the current requirement is less than three milliamperes.

Unlike mechanical devices, the relay (when operating) generates no high-voltage transients which can be hazardous to transistorised systems, and is itself unaffected by over-voltage and transient spikes. Another important feature is that complete isolation has been achieved between the direct-current operating voltage and the alternating-current semi-conductor output. (Solid State Controls Ltd., 30-40 Dalling Rd., London, WC1).

Cooker Thinks Ahead

Meat probes which anticipate what the temperature will be in the centre of the joint are now offered by the New Stanton Division of Robertshaw Control Company, Youngwood, Pennsylvania, U.S.A. They turn off a gas cooker before the meat is done, relying on the heat already in the joint to finish the cooking. The probe, connected by a flexible tube to the oven controls, is inserted into the joint. A thermostat reports when the temperature at the centre is approaching the desired point. This starts a 12-volt motor which turns off the gas.

Reduces Noise

A way of improving the sound-deadening characteristics of existing dividing walls in flats, public buildings and factories is announced by Alois Stankiewicz Chemische Erzeugnisse, Adelheidsdorf 51, Kreis Celle, Germany.

A plaster consisting of lead powder and PVC is applied by spraying or trowel to a thickness of about ¼ inch so that the natural frequency of the dividing wall is destroyed. Partitions made of steel, pressed wood, wood-wool cement, synthetic fibres and many other materials respond to the treatment, claims the company.

Rocket Motor

The United States National Aeronautics and Space Administration is closely examining a Nerva nuclear rocket engine, which is being stripped down for evaluation following an exacting series of running tests. Nerva forms part of the N.A.S.A. Rover program which aims at developing propulsion systems for space vehicles of the next decade.

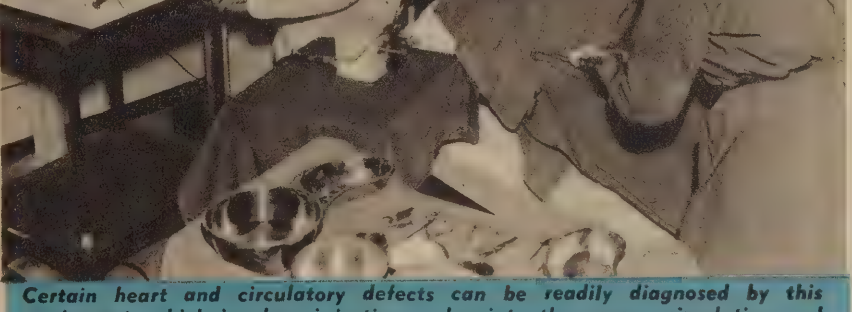
In the third and last test of the series the engine, which uses atomic heating of hydrogen to provide a powerful jet thrust, was operated at a power close to 500 megawatts. This power. 40 per cent of the design figure, was maintained for seven minutes and the total operating time in the test was 43 minutes.

Aerojet-General and Westinghouse Electric are the industrial concerns most closely connected with the project.

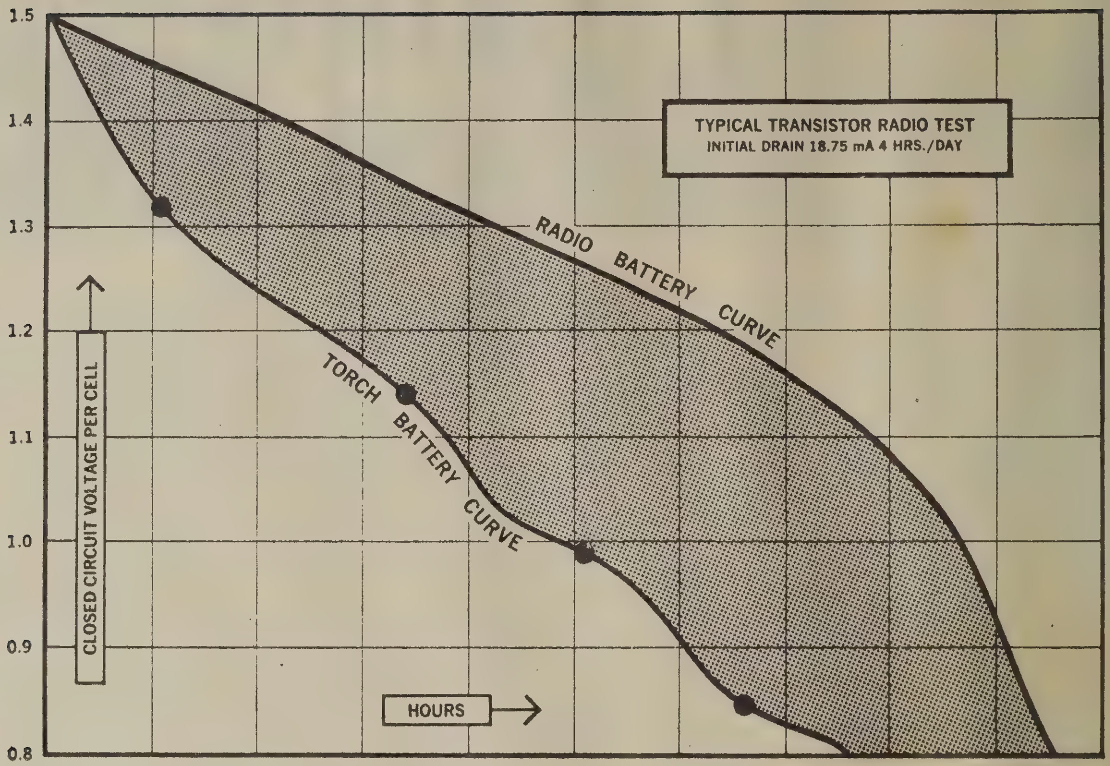
First Atomic Lighthouse

The world's first atomic lighthouse has begun its second year of operation. The beacon, drawing electricity from the radioisotope strontium titanate, began work in May 1964 in the United States Coast Guard's Baltimore lighthouse in Chesapeake Bay, Maryland. It is designed to operate unattended for 10 years. The atomic power plant supplants batteries that had to be replaced yearly.

The Coast Guard reported that the performance of the atomic lighthouse "has been completely reliable and generally excellent." Similar United States atomic units supplied power to satellites orbited in 1961 and are also furnishing electricity to automatic weather stations in the Arctic, Antarctic, and the Gulf of Mexico; a navigational buoy in the Chesapeake Bay, and a sea-bottom beacon in the Atlantic ocean.



Certain heart and circulatory defects can be readily diagnosed by this equipment, which involves injecting a dye into the venous circulation and plotting changes in its concentration at points in the arterial circulation. Any variation from the normal pattern, as revealed by sensors or blood sampling, indicates abnormality of one kind or another. (Cambridge Instrument Co. Ltd., 13 Grosvenor Place, London, S.W.1.).



Just look at this extra performance!

This high discharge curve proves that "Eveready" transistor radio batteries outperform others

There's a big difference between batteries specifically designed for transistor radios, and ordinary flashlight batteries.

A domestic flashlight is used intermittently, and is fitted with a high-current lamp (500mA) where the load is a D.C. resistance. Flashlight batteries are designed for this kind of service.

In radios, where A.C. signals are amplified, different battery characteristics are required.

Hence the need for "Eveready" Red Label transistor batteries.

These are specially formulated with a "high" discharge curve to provide better reception, more power, longer and clearer listening. The reason? Higher voltage maintenance during life. Improved efficiency over a wide range of discharge currents, when operated for extended periods, also gives extra performance.

Red Label transistor batteries are just another example of the "Eveready" policy of custom-building batteries for specific applications.

"Eveready" Red Label transistor batteries are ideal for all radio and electronic applications, for tape recorders, record players and movie-camera motors, and for heavy duty flashlights and slide viewers.

You can always depend on "Eveready" batteries for longer, better performance.

Union Carbide sell batteries for every purpose Types available are: High-rate Alkaline Batteries, Sealed nickel-cadmium re-chargeable batteries, Mercury Batteries, Silver Oxide Batteries. From this comprehensive range we can supply the right battery for your specific need

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SCIENTIFIC NEWS—cont.

Cuts Closer

Rotary lawn mowers which Elmer R. Hickel claims will trim the grass close along a wall or raised kerb have been patented and are available for manufacture under licence. Hickel, of 554, Calhoun Street, Wichita, Kansas, says his model has long, narrow slots in the sidewall of the mower casing plus horizontal fingers protruding forward. The fingers gather in the grass and guide it through the slots, where the rotary blade can cut it.

Stretch Paper

"Elastic" properties can be given to paper with a treatment developed by Billeruds Aktiebolag, Saffle, Sweden. A moist paper web is mechanically shrunk in its longitudinal direction and most of the moisture content removed by drying while it is hanging freely so that unrestricted shrinkage takes place in its width. Paper treated in this way is stated to exhibit extensible properties in both directions and to be useful for a wide variety of packing purposes.

Twilight Television

A camera has recently been developed that can automatically view scenes in light ranging from daylight to starlight. The new camera system, designed primarily for military field use, has been built with all solid-state components for compactness and light weight. Developed by RCA's Aerospace Systems Division, the "ruggedized" camera employs a new intensifier vidicon pickup tube instead of the image orthicon usually found in low-light-level television applications.

Capable of broad nighttime usage on tactical missions involving helicopters and other aircraft, the vidicon camera is also well suited for television missile guidance applications because of its ruggednesss, wide dynamic range, and sensitivity.

The camera affords the armed services the means for extending reconnaissance and surveillance capability into the hours of twilight, dusk, and darkness. It offers the additional tactical advantage of "real time" operation—the ability to witness an event at the moment it happens instead of viewing it later on film.

Rockets and Radar

Complete automatic equipment for analysing the effect of rocket motor flame on radar signals has been designed and developed by James Scott (Electronic Engineering) Limited, Carntyne, Glasgow, E.2., Scotland, on behalf of Britain's Ministry of Aviation.

Radar signals trasmitted from the ground to a missile or vice versa in most cases have to pass through the rocket motor flame path. This has the effect of both attenuating the signal and also inducing spurious noise modulations. The characteristics of different types of motor vary and it is essential that the radar system designers be provided with this information.

The "Allscott" equipment consists basically of a trasmit/receive system with facilities for accurately determining the attenuation of the appropriate signal frequencies by the flame, combined with a multi-channel high speed recorder and incorporating a specially designed analyser having extremely high sensitivity capable of detecting low order noise modulations induced by the flame. Interest has been shown in this equipment by U.S. rocket motor design authorities.

Data Recording

A high-density feature that doubles the data rate of magnetic tape units designed for use with IBM System/360 has been announced by IBM. The improved IBM 2400 series units will pack 1,600 letters or 3,200 numbers into one inch of standard magnetic tape—twice as many as before—and the most yet reported for any comparable tape unit.

An advanced recording technique—called phase encoding—enables the 2400 series to read or write up to 189,000 "bytes" (one letter or two digits) of data a second, equivalent to more than 2,000 IBM punched cards.

Claimed to be four times faster than teletypewriter equipment now in use, the machine pictured above, developed by Kleinschmidt, is soon to be introduced into the American Army's world-wide strategic communications network. Compatible with present systems, the new equipment can operate at up to 400wpm. Amalgamated Wireless (Australasia) Ltd. are the Australian representatives.

Until now, phase encoding has been available only in the IBM 7340 Hypertape system, an ultra-high speed unit which automatically loads and unloads cartridges of special, one-inch-wide tape. The 2400 series use manually loaded standard reels of half-inch magnetic tape. The improved 2400 series units can use all existing tape libraries.

Also available for the new 2400 series units will be a half-inch tape specially tested for greater reliability. The new IBM tape is Total Surface Tested. This means that surface flaws are now virtually eliminated between recording tracks. Otherwise, these flaws might later shift into the recording area and cause errors. The new tape is also compatible with all other IBM units using half-inch tape. (IBM Australia Pty. Limited, IBM Centre, Bradfield Highway and Kent Street, Sydney.)

Compact Magnetron

A versatile, permanent magnet magnetron, which providws 1,000, 750 or 500 watts of CW power at 2450MC, has been introduced by Litton Industries Electron Tube division. Designated the L-5001, this tube is a major addition to the family of microwave tubes designed for electronic heating and cooking applications. The tube is forced air cooled, operates at a significantly lower anode voltage than previously available for a comparable product, and was designed for maximum ease of mounting and accessibility. The L-5001 is a fixed frequency CW magnetron operating at 2450MC. It is lighter in weight and smaller in volume than any comparable tube.

(Litton Industries, Beverly Hills, California, U.S.A.

Electric Shoe Polisher

The Sanyo Electric Company, 2-18 Keihan Hondori, Morigunchi City, Osaka Pref., is putting an electric shoe polisher on the market. Neatly made and easily held in one hand, it is to be offered for about 10 dollars. Initial production planned is 20,000 a month.

Spurious Coins

Simple electrical testers which discriminate between genuine and counterfeit coins and which are far less bulky than others of this type are reported by Tateisi Denki K.K.K., 10 Hanazonotsuchidocho, Ukyo-ku, Kyoto, Japan. Using a genuine coin as a standard, the coin to be tested is placed on a slab of insulating material so that it forms an electrical capacitor with a parallel piece of metal underneath the slab. The capacity of the capacitor so formed varies from the standard value if the coin is spurious and a reading on a scale shows whether it is genuine or not.

Pictured at right is EMMA—Electron Microscope combined with Micro-Analyser. The first of its kind in the world, the instrument provides information about the chemical composition and crystallographic structure of particles as small as four millionths of an inch in diameter. (Tube Investments Ltd., Hinxton Hall, Cambridgeshire, England.)

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Photocell Sees Red

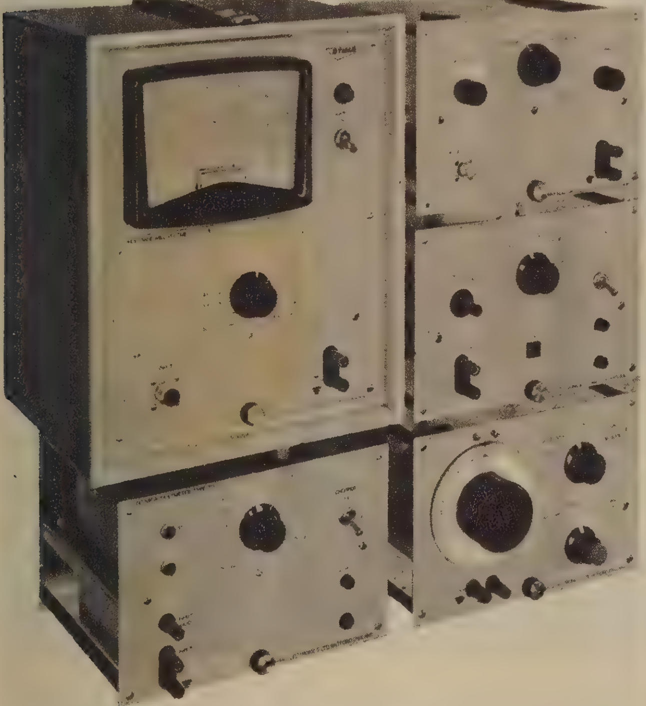
A.E.G., of 6, Frankfurt am Main-S says it has succeeded in producing a photocell with such a wide range of spectral sensitivity that it can readily detect red and blue. It has been built into a detector which is suitable for picking out particular colour markings printed on a background of a different shade, a problem which occurs, for example, in the printing trade. Materials such as paper or packaging materials can be scanned at high speed even when the printing marks are very small. The response of the cell is almost instantaneous it is claimed.

Simplified Counter

A single decade counter only slightly taller than a match has been built to read-out backwards from 9 to 0, contacts being supplied for an additional impulse at any one of 10 positions in a slightly more complex version.

The counter may be set to 0 to 9 electrically and has a carry pulse contact for transferring from decade to decade.

Minimum life expectancy of the simple, rugged unit is put at 40 million impulses by the makers, Radiatron of 7 Sheen Park, Richmond, Surrey, England.



A new range of plug-in measuring instruments has been released recently by Dymar Electronics Ltd. Initial units in the range include a wide-band millivoltmeter, a DC microvoltmeter, a kilovoltmeter, an AF signal generator and a noise factor meter. Details of the instruments are available from Ronald J. T. Payne Pty. Ltd., 385 Bridge Rd., Richmond, Victoria.

Fast Batch Counter

Large or small products coming direct from machines or feed systems at speeds up to as much as 2,000 items per second can be tackled by two new batch counters. They are available with or without numerical readout and can be operated by many types of switching devices from micro-switches to inductive transducers.

Each has selector switches to set any desired quantity from 1 to 9,999 articles. It will then count batches repeatedly to this number and register each one on a six-digit electromagnetic impulse counter.

A built-in switching function can be used to control gating or routing mechanisms on conveyors or feed chutes. The batching operations can thus be automatic once the mechanism has started. Makers are Electronic Machine Control company of 5 Beeches, Avenue, Carshalton, Surrey, England.

Bonding Zirconium and Steel

Zirconium and stainless steel can be bonded by extruding them at the same time through the same nozzles, reports the General Nuclear Engineering Division of Combustion Engineering, 200 Madison Avenue, New York 16.

The billet for extruding consists of a hollow cone of steel outside a cone of zirconium alloy. As this is extruded, the extrusion comes out as zirconium coated with steel in a good adherent bond. Tests show the alloy will fail before the bond, it is stated. General Nuclear says extrusion temperatures are critical to keep down interaction between the two metals.

Electronic Ore Sorter

A Canadian Mines Department research team has developed an electronic device for sorting ores containing heavy elements.

Its major use is expected to be in sorting ores containing molybdenum, tin, caesium, mercury and lead, but it can spot any element with an atomic number greater than 36. This means that it cannot be used for copper, iron, silicon or beryllium ore.

The ore is bombarded with radiation from artificially produced strontium 90, causing X-ray characteristics of the elements present to be produced. In the case of molybdenum, the device will detect as little as 0.1 per cent of this element in a piece of ore. As this very small concentration is uneconomical for present methods of refining, the sorter can be set to detect only higher amounts.

Eat The Wrapping

Protective films which can be eaten with the food they enclose are now available from the American Maize-Products Company, of 250 Park Avenue, New York 17. The film is made of amylose, a corn starch derivative which can be digested easily.

The film is expected to be used first to pack gravies, sauces and individual servings of coffee or soup. The film packet can be merely dropped in hot water and the whole brew eaten or drunk.

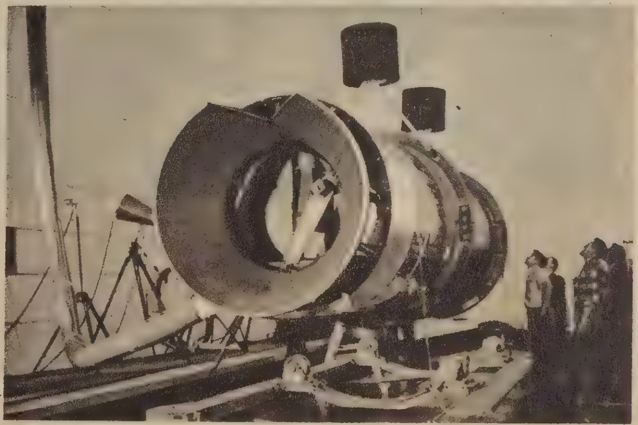
The film was made commercially feasible by development of a special species of maize with a high amylose content. Ordinary maize has only about 27 per cent, not enough for commercial production.

Mile-Wide Atom Smasher

Four engineering consultant companies in the United States have been selected by the Atomic Energy Commission to begin the study of a gigantic proton accelerator, or atom smasher, which will take the form of a ring one mile across.

Final designs will not be frozen till 1967 for this £100 million venture which will require six to eight years to complete.

The United States National Academy of Sciences is to carry out the work of examining possible sites and a selection will be made before the end of the year.



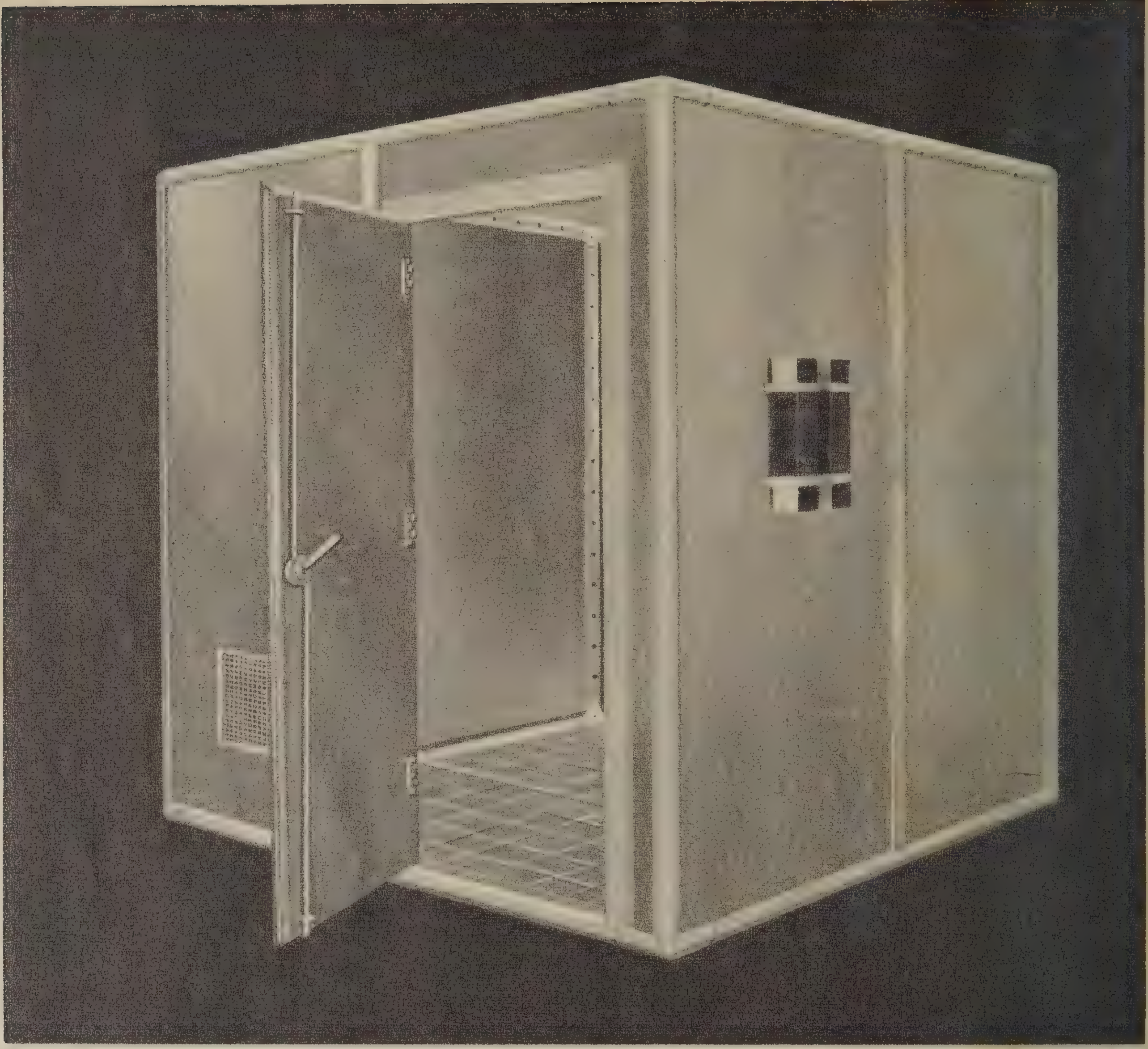
With 140 successful launches to its credit since 1958, including the highly accurate Mars probe, the Agena space vehicle will be deeply involved in forthcoming "docking" experiments, or the art of making a rendezvous in space. In the above picture Lockheed engineers are shown checking an Agena space vehicle in a huge test chamber, which is fully shielded from radio interference and internally echo-free.

The beam of accelerated particles to be produced by this machine will have the immense power of 200 Giga electron volts (200,000 million), or eight times as much as the big European machine at Cern in Switzerland and 13 times as much as Britain's Nimrod accelerator.

Metal Cleaning Process

A simple surface treatment for iron and steel articles, which not only removes any rust, grease or paint adhering to them but also polishes their surfaces, is claimed by Soc. Industrielles des Coussinets, 12, Rue de General Foy, Paris 8eme.

The process, an electrolytic one, is carried out in an alkaline solution containing sodium orthosilicate, sodium cyanide, Teepol and sodium tripolyphosphate. A few minutes treatment transforms old iron articles to bright ones, claims the company.



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Measuring Waves

An ultrasonic device for measuring ocean waves, the first to give point-by-point measurement of wave height from ships, is undergoing tests to determine its possible use as a new look in oceanography, meteorology, and antisubmarine warfare. The shipboard device, mounted on the bow of a vessel, is a self-contained electronic wave-recording system designed to measure the height of waves up to 40 feet with an accuracy of at least 95 per cent, regardless of the ship's motion. The profiles of the waves are printed out on paper so that an analysis can be made of various wave frequencies. From this analysis, scientists can determine how far away, how intense, and how long-lived was the storm that produced the waves.

The device determines wave heights by use of an echo-ranging sound sensor, which operates essentially like radar. It bounces its 38,000-cycle sound signals off a point on the wave and measures the distance by timing the echo. The variation in height due to the ship's motion is compensated for by a gyroscopic and inertial device. The end result is a true indication of the height of the point on the wave above sea level. The points are recorded by a print-out device to show wave profile. They are fed into a computer, separate from the wave-height sensor system, that acts as a spectrum analyser to determine the frequencies of the wave. (From RCA "Electronic Age," Spring 1965).

Build-you-own Roof

A strong, lightweight roof which is said to be so simple to erect that it requires no skilled labour can be made with plastic tiles and battens devised by Ernst Schmidt, Krempdorf, Holstein, Germany. The PVC battens have a flange for engaging the rafters and the tiles are fitted with projections which clip into holes provided in the battens—rather like press-studs. Laying the tiles is claimed to be easy since unless each is correctly laid it is impossible to carry on. With appropriate colouring the roofs could appear to be made of conventional materials.

Concreted Grass

It looks like grass from a short distance but it is in fact a concrete road surface. Developed by Gemeemtekwekerij Frankendaal, an Amsterdam municipal nursery, the system was originally designed for aesthetic reasons—in order that car parking areas should not appear to swallow up all the green open spaces. Another application could be the hard shoulder of a motorway.

The system consists of concrete slabs measuring 16 by 24 inches and criss-cross patterned with deep grooves. The slabs are laid like paving stones and earth mixed with grass seed is put in the grooves to just below the level of the blocks. When cars drive over the surface they do not damage the grass, which nevertheless hides the blocks from view.

The unit pictured at right, for measuring absolute levels of background noise, is equipped throughout with silicon transistors. Incorporating a calibrated amplifier, with full control facilities, a psphometer filter and measuring instrument, the unit has an inherent noise level of 115dB and a measurement range of from —95 to +15dB. (Laboratoire Electro-Acoustique, 5 Rue James Parent, Rueil Malmaison, France).

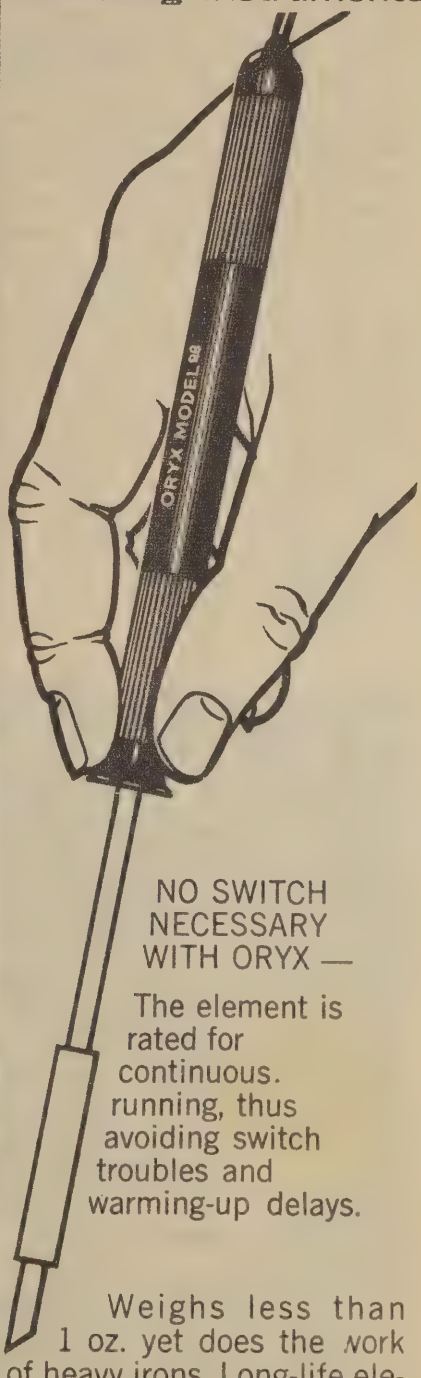
Corrugated Cardboard

Production of ultra-thin corrugated cardboard packing materials has been started by Hitchen Daley and Co., of Belper, Derbyshire, England. A new type of machine is used on the cardboard "fluting," which can now be produced in widths as small as 1/16 inch. The company states that "The cost of the material is very small, and the new method will mean that cardboard containers can now be made for the smallest of items and not just for bulk packaging."

Storage for Drawings

Lengths of hexagonal steel tubing arranged horizontally one above the other are used by a Japanese manufacturer to form a filing unit for drawings and blueprints. The drawings are contained in round cardboard containers which, because of the hexagonal shape of the tubing, can be slipped in and out quite easily. Two types of this storage unit are being made. One has 16 lengths of tubing and fits on a desk—the other has 36 tubes and stands on the floor. The manufacturer is Mori Shoko Company, 14 1-chome Nishi (West), Ebisu Shibuya-ku, Tokyo.

Scientists, attached to North American Aviation, at Downey, California, are investigating the physical stresses which might be involved in America's Apollo program designed to place man on the moon. Dummies, known simply as "Andy," with inbuilt instrumentation, are the "victims" for many of the tests.



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A PREAMP FOR MAGNETIC PICKUPS TAPE HEADS

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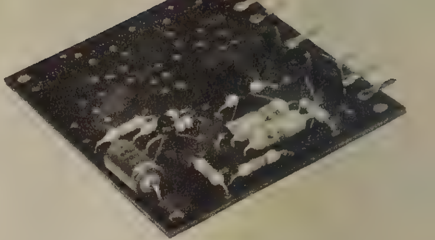


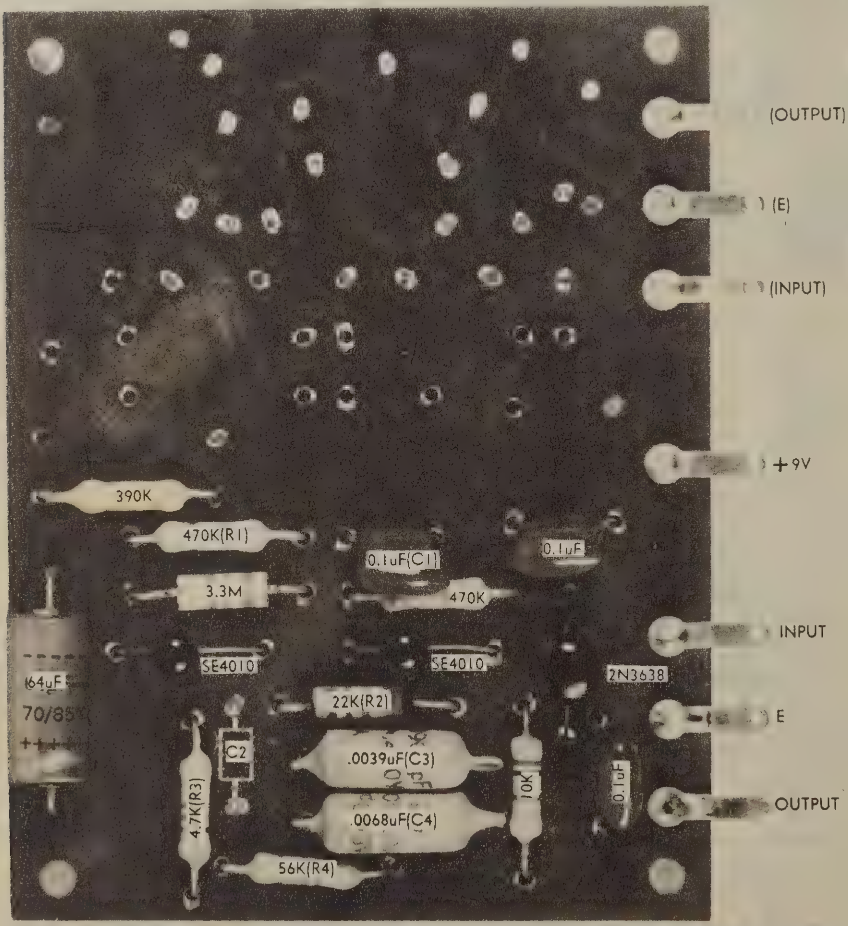
by Jamieson Rowe

The preamplifier described in this article may be used with either magnetic pickups or tape heads. It uses silicon transistors and has a high input impedance to obviate input matching problems. The gain is high, and can be adjusted as required; full R.I.A.A. or C.C.I.R. equalisation is provided, and the signal-to-noise ratio is better than that of comparable valve designs. The use of a printed wiring board makes assembly a simple matter.

A preamplifier ("preamp" for short) is required when it is desired to feed the signals from a high-quality magnetic pickup cartridge or tape head into an amplifier or radio receiver having an input intended for signals at "crystal pickup" level—250mV or so. The purpose of the preamp is to amplify the small magnetic pickup or tape head signals to this level and to supply any tonal equalisation required to make the signals "flat" over the audio spectrum.

Although valve preamps are often used in these applications they are by no means free from problems in terms of supply convenience, microphony, hum and noise. Transistorised preamps tend to be somewhat more convenient in terms of power supply, do not suffer with microphony and also tend to be less of a problem with respect to hum. Noise can still be a problem, even with modern transistors but, with careful design, the noise of a transistor preamp can be lower than that of comparable valve unit.

In view of this it is perhaps not surprising that the transistorised preamps which we have described in the past have proved to be very popular projects, particularly as "add-on" units. All used germanium transistors, and were variations of the same basic design; they were published in November, 1961, August, 1962, December, 1964, and July, 1965.



This photograph shows the preamp board with only one channel wired as would be the case for mono. The components visible are those required for a fairly high output magnetic pickup—note that R1 is only 470K. Capacitor C2 is only used for tape. The input resistor Rin and capacitor Cin (used only for tape) are not mounted on the board.

Although our germanium preamps have shown themselves to be excellent performers—and they are still regarded as current designs—they have a shortcoming. Or perhaps we should rather put it that they have a common characteristic which, in some cases, proves to be a shortcoming. In other cases, notably those in which hum pickup is a problem, it proves to be something of an advantage.

The characteristic to which we refer is their low input impedance and associated high - value electrolytic input coupling capacitor.

The low input impedance is virtually a function of the characteristics of germanium transistors. Using germanium transistors it is admittedly possible to obtain a higher input impedance than was obtained in our design but there is a catch, in the form of noise. To keep noise down, when using germanium transistors, it turns out to be desirable to sacrifice input impedance.

It is true that with the magnetic pickup versions of the germanium preamp the low impedance input as such was not a problem. In fact, we took advantage of it in providing the necessary R.I.A.A. equalisation (see the November, 1961, article, also "Off The Record" of August, 1961). However, the difficulty is that certain pickups differ from "normal" in terms of source inductance; these pickups are thus not really compatible with the design and acquire other than optimum equalisation.

The version of the preamp described for use with tape heads has encountered fewer problems of this type to date, though perhaps only because fewer types have been involved. However, the electrolytic input coupling capacitor required because of the low input impedance caused a certain amount of concern involving leakage and depolarisation.

Any leakage current passed by this capacitor will cause magnetisation of the tape replay head, and this will cause excessive replay noise. Thus it is essential with the December, 1964 unit to use high-quality electrolytic capacitors in the input position; preferably the low-leakage tantalum oxide or solid tantalum type. The problem is aggravated by the low DC voltage present across the capacitor, as this encourages depolarisation of electrolytics.

The dynamic microphone version of the design published in July is perhaps the least troubled by input matching problems, as microphones are fairly well standardised in terms of source impedance. However leakage in the coupling capacitor could well cause distortion due to displacement of the microphone speech coil or magnetisation of the coupling transformer, where present.

Admittedly the low input impedance of the germanium preamps can be an advantage, as we suggested earlier. With such input circuits the preamp noise is generally lower than with high impedance circuits, while the susceptibility to hum pickup by both transducer and preamp from turntable and tape-deck motors, power transformers and mains wiring is also lower. As the output from magnetic pickups and tape heads is quite low, this can be an important point.

However, from a general design point of view, electrolytic capacitors must be regarded as the least reliable of minor electronic components. A circuit designer is most satisfied when he has reduced their number to a bare minimum, and he is especially uncomfortable when forced to use one as an input coupling capacitor in a very low level circuit. Thus, ever since we described the germanium preamps, we have had reservations about the design, and have always been on the lookout for ways of obviating the input matching problem.

The recent release of silicon transistors at low cost for home construction gave considerable food for thought in this direction, because silicon transistors offer the advantages of stability, low noise and high gain at very low collector currents (see the article in the August issue, "Silicon Transistors in Audio Circuits"). They are thus potentially very suitable for use in low-noise, high-impedance input circuitry.

In view of this, we recently carried out quite a number of tests and experiments with various transistor configurations, aided and directed in no small measure by transistor applications data and by helpful suggestions from manufacturers such as Fairchild Australia. The results of our efforts may be seen in the new preamp design presented on these pages.

Employing three silicon transistors per channel, the unit may be used in conjunction with either magnetic pickup cartridges or tape heads. The input impedance may be set as high as 100K, obviating the input matching problem. While the signal-to-noise ratio is better than comparable valve designs, it is not quite as good as the germanium preamps —high input impedance is not obtained without some increase in noise.

The gain is high, and should be sufficient to produce more than 200mV output with all medium-impedance magnetic cartridges and tape heads. The gain is adjustable to permit the user to make the optimum compromise between signal-to-noise ratio and overload margin. Full R.I.A.A. disc or C.C.I.R. tape equalisation is available.

The attractiveness of the unit is high from the point of view of power supply convenience, since it can be powered in any of three ways: from a 9V battery, from the HT line of the amplifier or radio via a zener diode circuit, or from a small rectifier circuit fed with 12V AC. The latter may be supplied by a small heater transformer, or taken from the small winding provided on some gramo turntable motors.

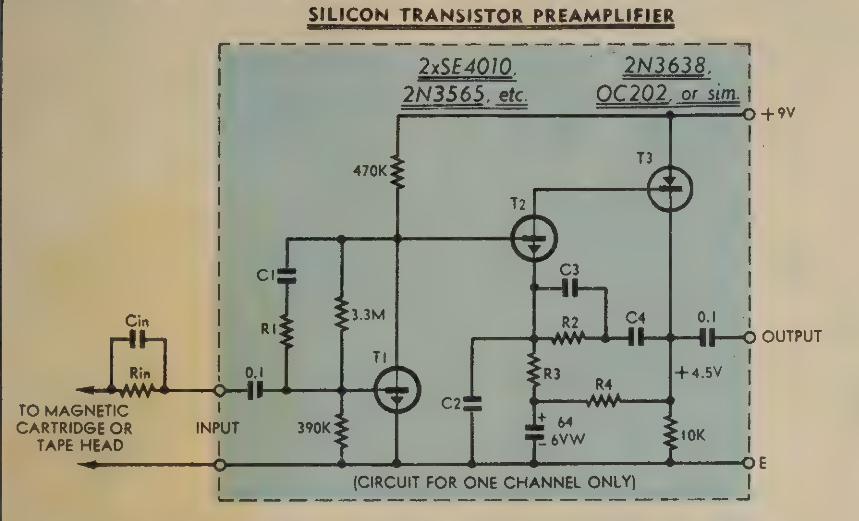
As may be seen from the circuit diagram, the preamp uses one PNP and two NPN transistors per channel. Transistors T2 and T3 are connected in a direct-coupled feedback amplifier circuit which is used to provide equalisation, while the input transistor T1 is used as a low-noise preamplifier stage.

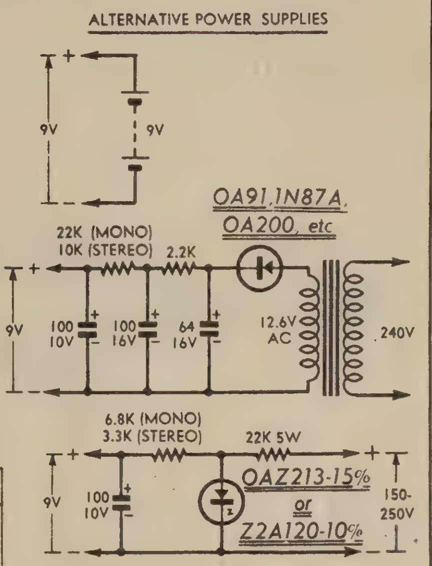
Local negative feedback around T1 allows the overall gain of the preamp to be adjusted. With R1 (and C1) omitted, the gain is maximum—approx. 150 for magnetic pickup and 100 for tape, at 1KC. Decreasing values of R1 from about 4.7M reduce the overall gain.

The adjustment of overall gain will be a compromise between distortion and noise. From the point of view of distortion reduction it is advisable to keep the gain low, to ensure that T3 and any other stages which may follow it ahead of the system volume control do not overload on signal peaks. However, from noise considerations it is preferable to operate T1 at the maximum allowable gain.

The actual setting selected will depend upon the output of the pickup cartridge or tape head and the sensitivity of the following amplifier. It will also depend upon the value of input resistor Rin, selected to suit the cartridge or tape head in use.

If an oscilloscope is available to monitor and measure the preamp output, the gain of the preamp may safely be





USE		Cin	Rin	C1	R1	C2	R2	C3	C4	R3	R4
MAGNETIC P.U. CARTRIDGES		NOT REQD.	100K OR 50K TO SUIT CARTRIDGE	0.1 (ONLY REQD. IF R1 USED)	470K TO 4.7M, IF USED. SEE TEXT	NOT REQD.	22K	.0039	.0068	4.7K	56K
TAPE HEADS	7.5ips	100pF	100K	——	——	.001	10K	—	.0022	22K	33K
	3.75ips	100pF	100K	——	——	.001	56K	—	.0022	22K	33K
	1.875ips	100pF	100K	——	——	.001	100K	—	.0022	22K	33K

BLUE OVERPRINT SHOWS WIRING ON PRINTED BOARD

The circuit for the new preamp, together with a table showing the component values required for use with magnetic pickups and tape heads. Also shown are the alternative power supplies which may be used. The use of a printed wiring board makes the preamp an ideal project for those with little experience at wiring up electronic circuits.

COMPONENTS NEEDED FOR ONE CHANNEL:

1 Printed wiring board, 4in x 3in, pattern as shown.
2 NPN silicon transistors, type SE4010 or similar.
1 PNP silicon transistor, type 2N3638 or similar.
1 10K ½ watt resistor.
1 390K ½ watt resistor.
1 470K ½ watt resistor.
1 3.3M ½ watt resistor.
2 0.1uF miniature plastic capacitors.
1 64uF 6VW electrolytic capacitor.
Rin, Cin, R1, R2, C2, R3,
C3, R4, C4 as required (see table).
Power supply components as required.

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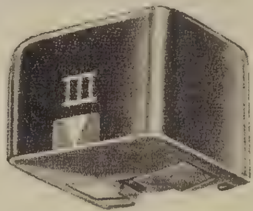

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ELIPTICAL diamond stylus: .0003" × .0008"
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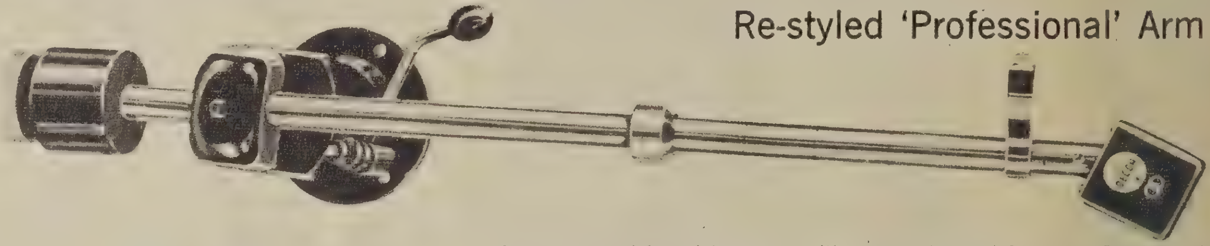

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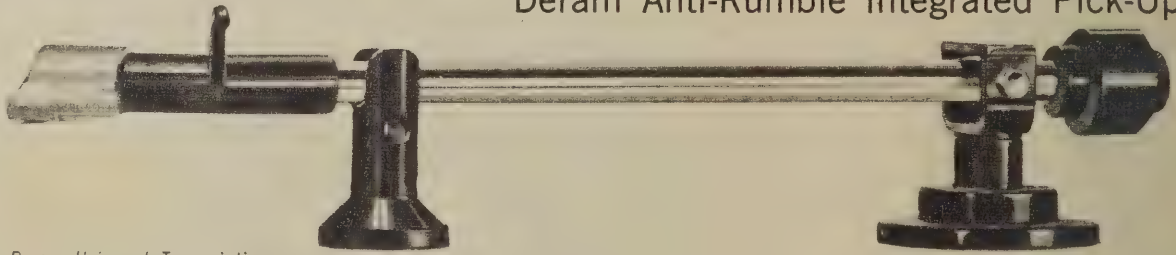
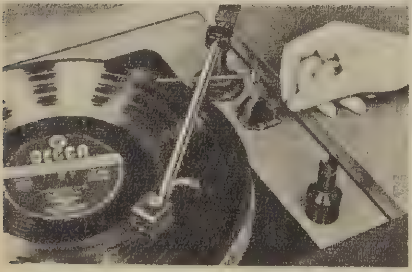


Deram Universal Transcription Arm, to accept all ½" cartridges, also available. Price, complete with head shell, £8/19/6.

In the Decca Deram ARI pick-up, the mechanical combination of arm and head has been arranged to effect directionally selective filtering which almost eliminates the most troublesome rumble frequencies without reducing any required low frequency signal. The arm will accommodate all Deram pick-up heads. Price complete, £15/5/6.



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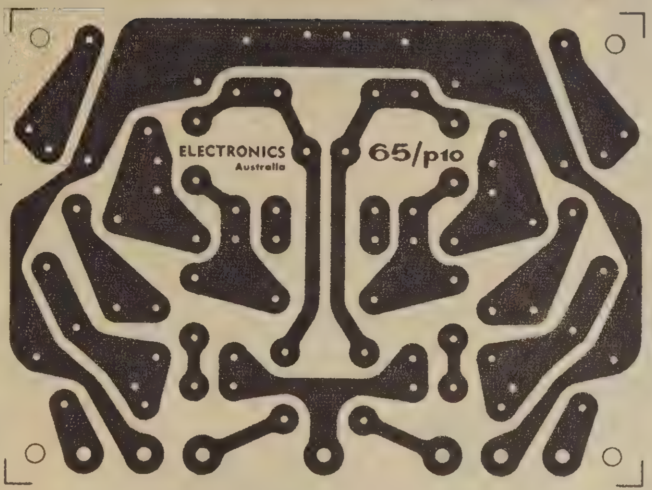
the board pattern



The wiring board pattern for the new preamp, reproduced a little smaller than actual size. With space for parts and wiring for two channels, the board measures 4in x 3in.

increased until the output on peaks of "loud" signals is about 1V (2V P-P). This leaves a safety margin of more than 6dB, as the preamp will deliver over 2V RMS before serious distortion occurs. Of course, with low output cartridges or tape heads it may not be possible to obtain 1V output on peaks; in this case, use maximum gain by omitting R1 and C1.

In the absence of test instruments, constructors would probably be best advised to reduce the preamp gain to a value which is just a little more than that required to obtain full output from the main amplifier with the volume control "full on." But note that this assumes that the "full on" sensitivity of the main amplifier is somewhere between 200 and 700mV. With more sensitive amplifiers, it would be advisable from a noise point of view to run the preamp at a fairly high gain, and use a voltage divider to reduce its output by 2 or 3 times if this proves necessary.

Conversely, with less sensitive amplifiers the preamp gain should be kept well below the point where preamp distortion is evident to the ear. As a rough guide in such cases one could determine the value of R1 which results in slight audible distortion, and then put in half this value.

Because of the negative feedback arount T1 the fundamental input impedance of the stage is low, and an input resistor Rin must be used to match the magnetic cartridge or tape head. Although this involves losses, the gain is high and compensates for the losses quite comfortably.

It might be thought that this arrangement would result in a poorer overall signal-to-noise ratio for the preamp than would be obtained if all three transistors were included within the main equalisation feedback loop, as in the latter case the circuit could be arranged to have an inherently high input impedance and would not require an input padding resistor. However, this is not in fact the case, the circuit shown proving to have a better S/N ratio than a similar design with high input impedance and overall feedback.

Rin may be regarded as the cartridge or tape head load resistance, and is selected according to the manufacturer's data. In most cases it will be either 50K or 100K. If no details are given in the data, it would be wise to use 50K for a pickup cartridge and 100K for a tape head.

The values of the various circuit constants for tape and disc equalisation curves are given in the table. Using the table it should be a simple matter to select the components required for any application.

Transistors T1 and T2 should preferably be a type selected for low noise, such as the type SE4010 suggested; however, the results will often be almost if not equally as good with a standard high gain NPN type similar to the 2N3565. T3 may be a 2N3638, an OC202 or a similar high gain PNP type.

Details are given for three alternative power supply arrangements, as mentioned earlier. Note that the final filter resistors of the rectifier and zener diode supplies have different values if only one channel of the preamp is used (for mono).

The rectifier supply may be powered either from a 12.6V heater transformer, as shown, or from a turntable motor having a 12V winding provided for this purpose. The zener diode circuit should be used where it is required to power the preamp from the HT line of the main amplifier or radio receiver.

Construction of the preamp should be a simple matter as all components except Rin and Cin are mounted on a small printed wiring board. The coded photograph should make it easy to fit the components in the correct positions on the board, using the circuit diagram and board pattern reproduction if necessary.

When mounting components on the board remember not to bend the leads too close to the component body. Also do not bend the leads sharply, as this encourages fracture. When soldering to the copper laminate use a small iron and work quickly to avoid overheating the board and component.

The completed preamp will have to be shielded from AC fields to avoid hum pickup. This is in contrast with the germanium preamps, where the impedance level was low enough to make shielding unnecessary.

In many cases it will be possible to fit the preamp inside the main amplifier or control unit case, and this will very likely provide sufficient shielding. However, if this is not possible an earthed shield box will have to be used, bent up from sheet steel, tinplate or aluminium.

When correctly shielded the hum output of the preamp itself is virtually zero. Most tape heads and magnetic cartridges will pick up more hum than that contributed by the preamp when fully shielded, and if hum is a problem this should be borne in mind. Disconnecting the input from the preamp will soon show where the hum is entering the system.

This completes the description of the new preamp. Its excellent performance and considerable versatility should make it popular among audio enthusiasts. If wired up according to the data given, it should give many years of satisfying service.

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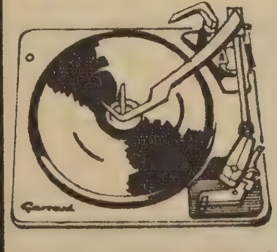

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TOROID BALUNS

This article describes the construction of two "baluns" which are suitable for coupling a coaxial cable to 75 or 300-ohm "balanced" antennas in the frequency range between 3 and 30MC. The baluns are compact, weatherproof devices which can be installed directly at the antenna and are capable of carrying up to 200 watts of transmitter output power. They are of special interest for all-wave receiving aerials in electrically noisy locations.

By Keith Jeffcoat

MOST amateurs are aware that a dipole or other form of balanced antenna should, ideally, be fed with a balanced or symmetrical feedline having a characteristic impedance equal to that of the antenna. Special twin feeder and "ribbon" type lines are available for this purpose but, for mechanical and other reasons, the majority of amateurs seem to prefer to use coaxial cables to feed their antennas.

Unfortunately, coaxial cable constitutes a non-symmetrical, or unbalanced feedline and certain problems are introduced when such a line is directly connected to a balanced antenna — notably impedance mismatch, SWR problems, distorted radiation pattern and a radiating feedline, which may lead to trouble with BCI and TVI.

Amateurs who operate in the VHF and UHF region are usually well aware of the overall problem and, where coaxial cable is used to feed a balanced antenna, they frequently install a "balun" at the feedpoint of the antenna.

Such baluns are usually made from short but specific lengths of coaxial cable. They are frequently called upon to perform a dual service in that they not only correct the balanced-to-unbalanced condition, which exists between the antenna and the feedline, but they also effect an impedance transformation where it is desired to match a 75-ohm coaxial cable into an antenna having an impedance of around 300 ohms.

These coaxial baluns have a definite place in the VHF and UHF field but they have found little favour with amateurs operating in the 3 to 30MC region for at least two reasons.

The first reason concerns the physical size of a coaxial balun at the lower frequencies. At 144MC a 1:1 impedance ratio balun consists of a length of coaxial cable approximately 19 inches long, suitably connected at the feedpoint of the antenna. At 7MC the same type of balun would need some 33 feet of cable, which becomes both cumbersome and costly.

The second problem is that a coaxial balun is essentially a one-band or one-frequency device. At VHF this is no special problem because most antennas used on these frequencies are themselves one-band devices. At HF, however, many amateurs make use of multi-band antennas, such as the trap dipole described in our May, 1965, issue and, in such a case, the coaxial balun becomes unusable.

There are various ways of minimising these problems but the most recent to appear on the scene, and the method we are concerned with in this article, is the use of ferrite toroids in the production of balun transformers.

While a variety of ferrite products may be used to construct a balun transformer, the toroidal configuration has the advantage of being compact and mechanically quite robust. Futhermore, the RF energy, both on transmission and reception, is substantially confined to the space bounded by the core and the winding, so that stray fields are minimised.

Using a ferrite toroid, it is possible to produce a balun which has the advantages of small size, low loss, and good broad-band characteristics.

In order to clarify matters, it may be helpful at this point to re-state the position in relation to balanced lines, unbalanced lines and the role of "balun" devices.

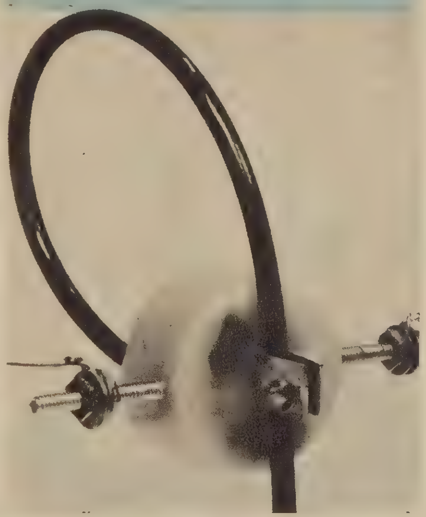
Perhaps the obvious starting point is a symmetrical dipole antenna, resonant at the appropriate signal frequency and centre-fed through a balanced, twin-lead feedline; it is assumed that the characteristic impedance of the line is equal to that of the antenna feedpoint and that the feedline drops away from the antenna at an exact right angle.

Under these idealised conditions, signal current flowing through the individual wires of the feedline sets up a field around each. However, because the currents — and fields — are of equal amplitude and opposite phase, and because the wires are very close together in terms of the operating wavelength, the fields cancel at any significant distance from the feedline and no radiation takes place from it.

Practical antenna systems depart somewhat from these idealised conditions because the antenna is not symmetrical in itself or with respect to adjacent structures, because the antenna and line impedances do not exactly match and because the feedline may not run direct to the transmitter at right angles to the antenna wire. Departure from the ideal is reflected in some rise in SWR (standing wave ratio) some distortion of the antenna feed pattern and some radiation effects from the feedline.

However, if a coaxial cable is substituted for a balanced feedline the natural symmetry of the system is fundamentally upset by virtue of the fact that the outer surface of the cable is connected to one side only of the antenna. The outer surface of the outer conductor, being exposed to the physical environment, has the effect of loading this particular side of the antenna so that, electrically, it appears to be longer than it really is.

These illustrations show the balun as it might be mounted in the centre of a dipole antenna. Note the simple aluminium clamp moulded into the back of the epoxy casing and used to retain the coaxial feedline.



If the system is operated in this fashion, at a feedpoint which is no longer the centre of symmetry, mismatch occurs because the cable will be terminated by other than the anticipated load impedance. The mismatch, as such, may be minimised by pruning the "long" end of the antenna but, either way, the system remains non-symmetrical.

This being so, its field pattern is non-symmetrical also and the outer surface of the cable is exposed to a non-symmetrical field, even though, ostensibly, it makes the nicest of right-angles with the antenna proper. Current is thus induced in the outside conductor, causing it to radiate directly and also to energise the particular antenna element to which it is electrically connected.

The result is a "hot" feed cable and the familiar and random effects, as mentioned earlier in the article.

Operators on the VHF bands commonly combat this situation by adding to the system a balun, made up from a scrap of coaxial cable.

A coaxial balun consists of a quarter wavelength of coax. cable in close proximity and parallel to the feedline at the antenna. The inner and out-

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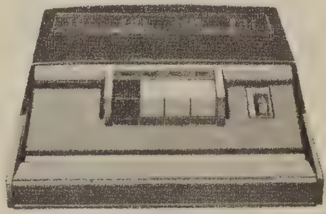

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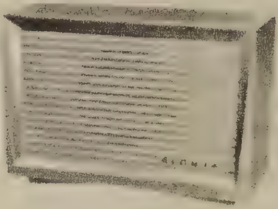

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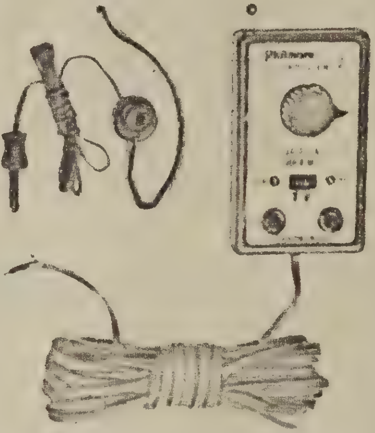

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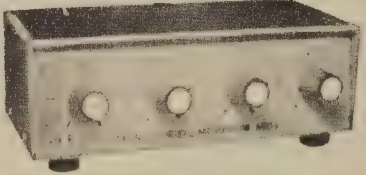

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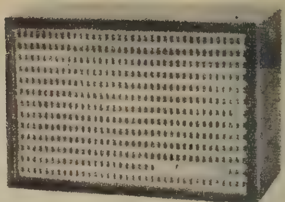

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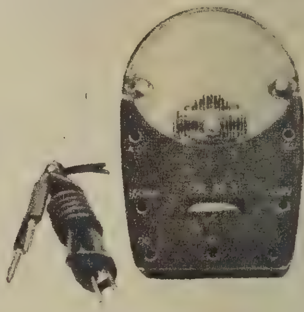

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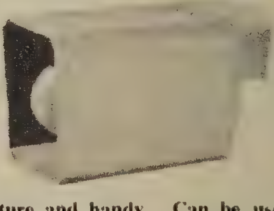

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er conductors of this section are connected in parallel and at one end terminated on the inner conductor of the feedline where it joins the antenna; the other ends are shorted to the outer conductor of the coax. feedline.

Although the section of coax. forms a short circuit across the antenna as far as DC would be concerned, this is of no consequence because at the frequency of operation the length is such that it forms a shorted quarter-wave section of transmission line. Thus it presents to the antenna circuit a very high resistive impedance which is negligibly large compared with the 70 ohms impedance of the antenna itself.

The vital effect of this extra quarter-wave section is that it adds a length of coax. cable sheath to that side of the antenna fed from the inner conductor of the feeder and restores the system, at least in the immediate vicinity of the radiating elements, to a fair semblance of symmetry. Discrepancy between the electrical and mechanical centre is minimised and, if the cable system is taken away at right angles along the centre line, it produces a minimum of interference with the lobe pattern.

Right: The 1:4 balun enables 75 ohm coax to be used as a feedline for a folded dipole antenna.

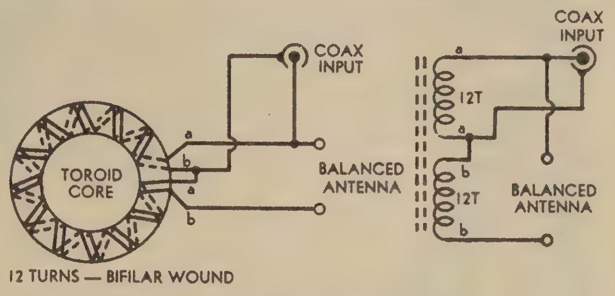


Fig. 1 **1:4 BALUN TRANSFORMER**

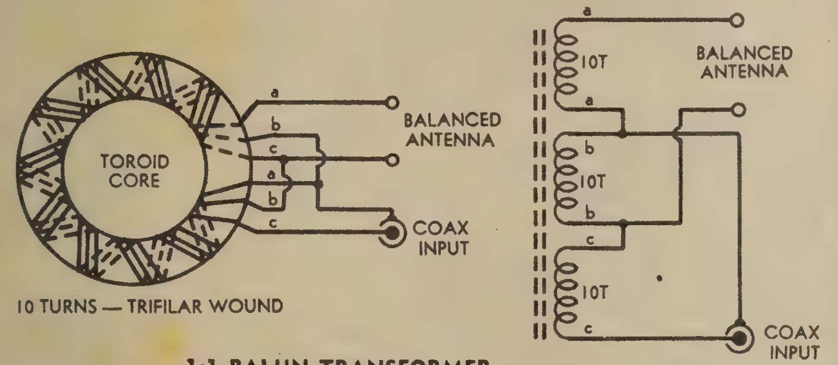


Fig. 2 **1:1 BALUN TRANSFORMER**

Left: The 1:1 impedance ratio balun, when interposed between the coax feedline and a "straight" dipole, will prevent the coax from unbalancing the system and becoming a radiating feedline.

The manner in which toroidal baluns work is quite different from the coax. cable type discussed. In the latter, the technique is to add something to the element fed from the inner conductor to equate it to the element already connected to the sheath of the coaxial feed cable.

In the toroidal type, the connection between the outer sheath and either antenna element is intercepted and replaced by a transformer winding, attacking the balance problem at its source.

To understand how toroidal baluns work we might commence by looking at the circuit of figure 1 which represents a simple example of the technique. It shows a 1:4 impedance ratio balun transformer designed, primarily, for matching a 75-ohm coaxial cable feedline to a 300-ohm balanced antenna.

In this case, the braiding of the coaxial feed cable connects to the "common" of two series-connected windings.

The inner conductor of the cable feeds one antenna element directly and feeds the second one, out of phase, by virtue of the two tightly coupled transformer windings.

The 1:4 impedance transformation between feedline and antenna is achieved because the antenna "looks" across the total number of turns in the balun while the feedline only "looks" across half the total turns. In this, and many other respects, the balun behaves as would a normal transformer.

In order to achieve a 1:1 impedance transfer while still retaining the necessary "decoupling" of the coax. outer conductor from the antenna elements, we need to add a third winding to the balun in the arrangement shown by figure 2. Here, again, the coax outer conductor is decoupled from the antenna elements by the windings "a" and "b", but in this arrangement the antenna and feedline "look" into an equal number of winding turns, so that the impedance transfer is 1:1.

Towards the high frequency limit of their range, the baluns run into trouble with such effects as capacitive shunting and winding resonance. For best high-frequency performance, then, a balun would use a core material having a fairly low permeability while the windings would have no more than the requisite number of turns necessary to provide tight coupling of the signal to the antenna.

At the low-frequency end of their range, the response is limited by the amount of winding inductance and for best results, the baluns need a core material having a fairly high permeability and wound with a largish number of turns.

It becomes obvious that the demand for high winding inductance, to produce satisfactory low-frequency performance from a balun, will inhibit the upper frequency limit of the device. In fact, baluns of this type can be made to function satisfactorily over a frequency range of about 10 to 1, which is sufficient to permit full coverage of the amateur bands between 3 and 30MC.

As might be expected, the question of balun bandwidth is also dependant on the impedance at which the devices must effect an energy transfer, with the lower impedances resulting in wider bandwidths being obtained. If, for example, it was desired to effect a 1:1 transfer at 1000 ohms impedance, the bandwidth of a typical balun would be, at best, about 2 to 1. This, however, is of mainly academic interest since coaxial cable is not generally available in impedances higher than 75 ohms.

In choosing a particular type and size of core material for the baluns, a good many factors must be borne in mind. An examination of these factors will show that no single grade of commercially available ferrite is ideal in its behaviour over the full range we may desire a balun to cover but the Ducon 1-5/16in diameter toroid, constructed from "Q-1" material, appears to be the most satisfactory of those available. The baluns described in the article are constructed around this toroid.

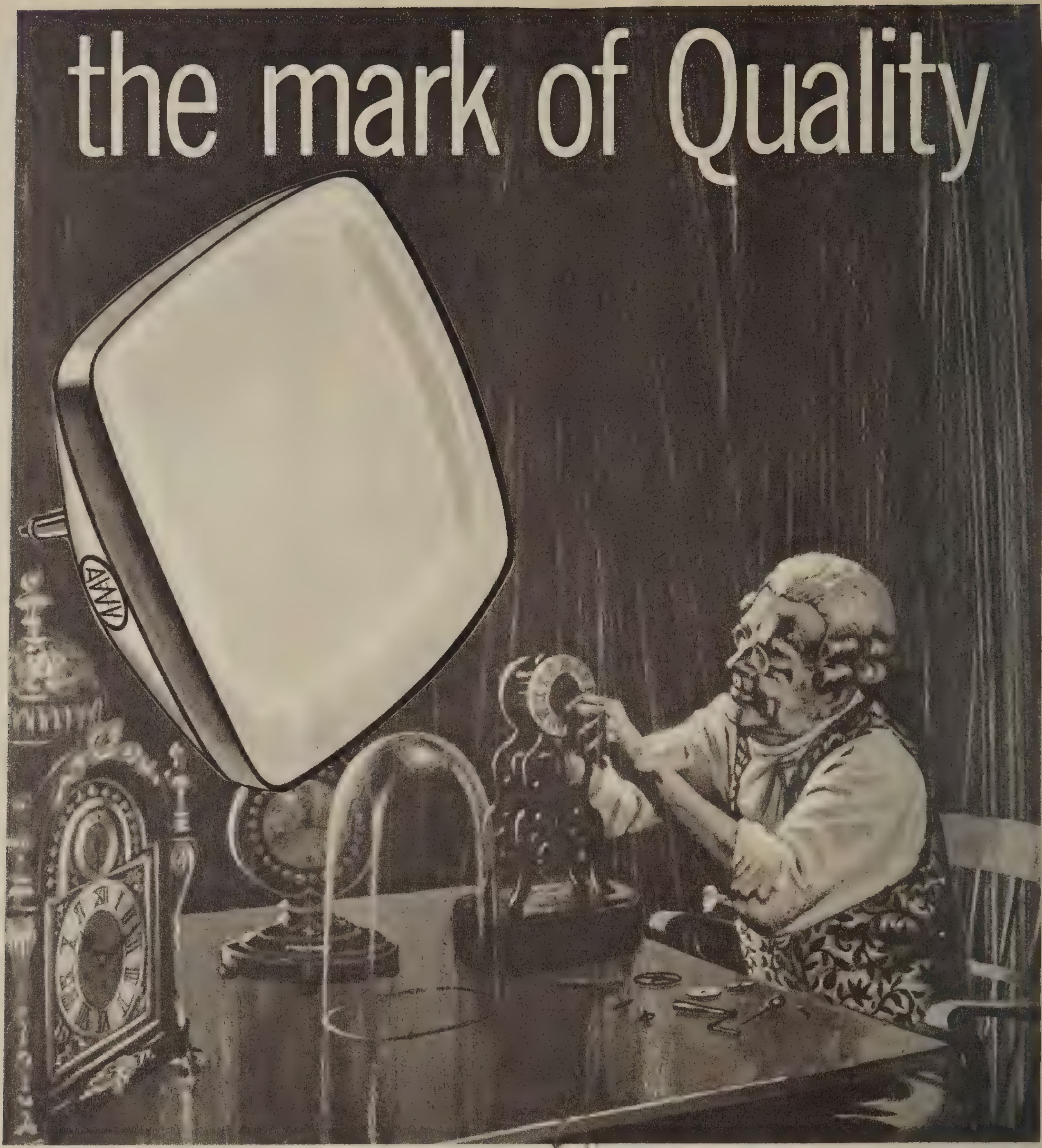
When constructed around a core of this type, a balun will safely handle up to 200 watts of R.F. power without heating of the core due to internal losses—PROVIDED there is no significant mismatch between the aerial and the feedline.

If a mismatch occurs the power dissipated in the balun will be increased giving rise to higher core losses and possible damage of the core, due to overheating, or damage to the winding due to electrical flashover.

With the limited power input permissable in this country, the balun will tolerate a fair mismatch between antenna and feedline before appreciable heating of the ferrite occurs. Use of the balun with a mismatched antenna, however, partly defeats its purpose, so efforts should be made to see that such a mismatch does not occur.

In our practical tests of the baluns, we ran them at powers of 250 watts, into a dummy load, before any noticeable warming of the ferrite occured. The loss through the balun, measured at 3.5 and 28MC and with a power output from the transmitter of 120 watts, was approximately 1db. This loss is so small as to be negligible and is more than compensated for by the lower SWR which can be obtained over a given bandwidth and with a given aerial.

Most amateurs are aware, for instance, that a folded dipole antenna has an inherently broader bandwidth than a straight dipole, but a folded dipole would normally require the use of a 300 ohm feedline and appropriate match-



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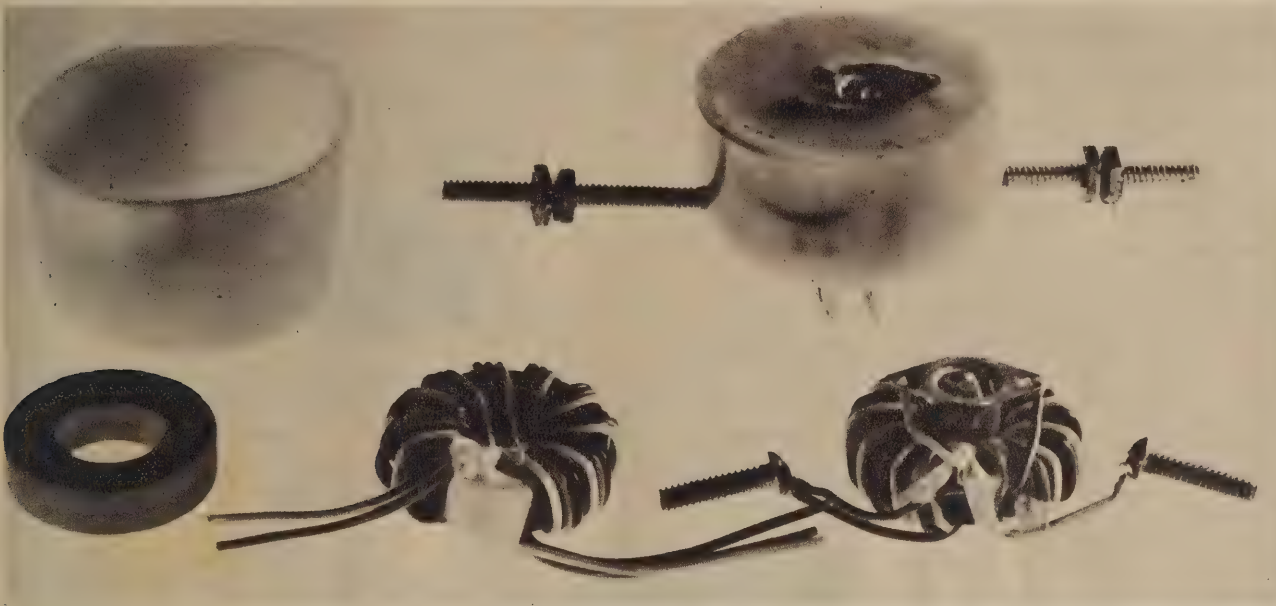
By using a folded dipole with the 1:4 balun, the advantages of a broadband antenna and a convenient coaxial cable feedline can both be achieved.

In constructing the balun, care should be taken that the ferrite core used is one without any signs of flaws or cracks. These materials are essentially non-conductive but any flaws or cracks in the material will seriously impair the performance of the transformer.



This diagram illustrates the various steps in the construction of our baluns. The completed unit, shown at the top right, can, if desired, act as a centre insulator for the dipole as well as its matching balun.

In winding the toroids, we used ordinary 7/010 plastic covered hookup wire in preference to enamel covered wire since the latter is subject to shorted turns if damaged by the sharp edges of the toroid. This plastic wire is also easier to handle and, being colour coded, it aids final connection, particularly with the trifilar wound 1:1 balun.

The length of each wire in the baluns is approximately 20in and the winding job is simplified if the wires are pre-cut to this length before commencing. As shown in our diagrams of figures 1 and 2, a bifilar or trifilar winding simply consist of side-by-side windings of equal numbers of turns.

In the case of the 1:1 balun, the total winding consists of three lengths of plastic covered wire wound side-by-side ten times around the toroid and making, if you like, thirty turns in all. It is important that the wires remain side-by-side as they are wound and not allowed to cross over at any point; if possible, the winding should be spaced to occupy the entire diameter of the toroid.

Our photograph, elsewhere in this article, shows the 1:1 balun in various stages of construction and a completed winding can be seen in this photograph.

Because the "Q" of the toroid material will suffer if it is subject to moisture, we enclosed the toroid and its winding in a moulded epoxy resin block. For good measure, a coaxial socket, two bolts to connect to the antenna and a coaxial cable clamp were also moulded in the block.

The coaxial socket we used is a type manufactured by Belling & Lee Ltd. and is ideal since it fits snugly into the centre of the toroid and its winding. The fact that the metal of the socket is in the centre of the winding is of no consequence, since it does not constitute a shorted turn.

In our photograph can be seen, at the bottom right, a toroid with socket and bolts attached and ready for potting whilst immediately above it can be seen a completely potted unit. The "mould" which we used to pot the toroids was simply the bottom of an ordinary, soft plastic drinking cup as shown at the top left in the photograph.

The cups we used are available at most chain stores. They measure approximately 2in in diameter at the bottom, about 2½in at the top and are approximately 4in in height. Any cup of about this size is suitable provided it is made from the soft PVC type plastic.

When the epoxy resin moulding has had time to cure it will become exceptionally strong and the two wires of the antenna can, if desired, be simply attached to the bolts protruding from the moulding and to which the antenna connections of the balun are internally soldered. The moulding can thus be made to serve the triple purpose of an antenna centre insulator, the tie point of the coaxial cable, and a weatherproof housing for the balun.

Included in our article are two photographs showing front and rear views of the balun suspended between two halves of an "aerial" and with the coaxial cable securely retained by the clamp moulded in the back of the unit. The coaxial cable shown in these illustrations is of the smaller, ¼in diameter variety, although a larger diameter coax. may be used if desired.

To prepare a mould for the baluns we cut away the top section of the cup, with a sharp knife, so that only about 1½in in length of the bottom remained. This is not absolutely essential but it makes it easier to mount the balun and its hardware in the bottom of the cup.

The cup is prepared by drilling a ⅛in diameter hole in each side, the two holes being diagonally opposed and about ¼in from the bottom of the cup.

Two ½in long by 1/16in wide slots separated by ¼in should now be cut, with a sharp knife, in the centre of the bottom of the cup. Make a small "U" bracket from a strip of 18-gauge aluminium measuring ½in wide by 2½in long and push it through the two slots in the bottom of the cup so that the curve of the "U" is inside the cup, with the bulk of the bracket protruding outwards.

When the bracket has been mounted, take the balun with bolts and coax. socket attached and gently ease the bolts through the two holes in the side of the cup until only ⅛in of their length is left inside the cup. Leave the toroid hanging slightly out of the cup so that the end of the bracket, the bolts and the bottom of the cup are clearly visible and accessible.

Mix approximately 2oz of epoxy resin (we used "Araldite") and pour about half the mixture into the bottom of the cup. Take a coax. plug, liberally smeared with silicone or a similar grease, and plug it into the coax. socket in the centre of the toroid. Use the plug as a "handle" to push the toroid well down into the mixture and pour in sufficient resin to bring the level up to about the top of the coax. socket.

Allow the mixture to settle for about 15 minutes and then "top up" if necessary to bring the level up to the coax. socket. Tap the side of the cup vigorously with a small metal implement to dislodge any air bubbles which might have formed in the mixture and then set the whole away for approximately 24 hours to allow it to cure.

At the end of the 24 hours the cup may be stripped away from the cured epoxy resin and the completed balun is ready for installation in your aerial.

Although we have placed a certain emphasis on the use of these baluns in a transmitting antenna, they do have corresponding advantages when used on an antenna designed for receiving only. The cancellation of a signal radiated from the feedline of a transmitting antenna has its counterpart in the cancellation of signals and/or noise picked up by the feedline when the antenna is used for receiving.

The balun would, for instance, be

(Continued on Page 142)

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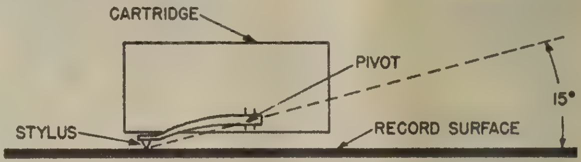

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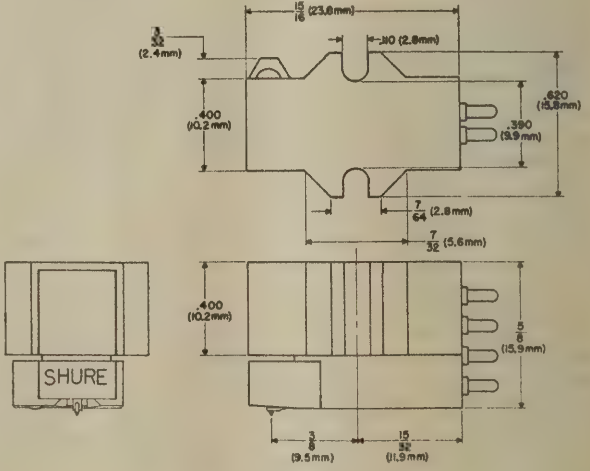

FIGURE 1

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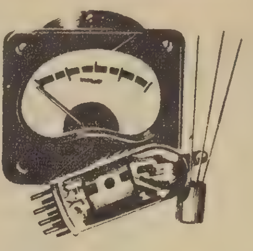


CHAPTER 23: Magnetic recording. Historical. Poulsen's early wire recorders. Stille's wire and tape recorders. Wartime developments. Principles of operation. Magnetic characteristics. Distortion and need for bias. DC bias. AC bias. Erasure. Wire and tape compared. Modern equipment.

ONE of the spectacular advances in electronics following the last war was the development of the tape recorder; a development which found ready acceptance by radio stations, artists, dramatic schools and clubs, and a host of others who had a special need for a simple sound recording system.

Their reaction was understandable. Most previous recording systems had called for extremely complex equipment, considerable skill to operate it, and expensive and lengthy after processes before the results could be heard. The acetate disc was a step in the right direction, but was still relatively expensive and inflexible.

The tape recorder, on the other hand, seemed to overcome all these problems in one sweep. It was relatively inexpensive to buy, simple to operate, required no processing and, above all, permitted erasure of mistakes and re-recording to correct them. This latter feature not only avoided waste of recording material, but also the precious time and effort put into what had already been recorded.

The development of the transistor and its application to the tape recorder permitted the latter to be developed to the point where it is compact enough, and priced low enough, to appeal directly to the individual. Even without any special requirement, the ability to make personal recordings appeals in much the same way as does the ability to make personal pictures with a camera. In fact, personal recorders are currently enjoying a popularity approaching that of the camera.

Where did it all start?

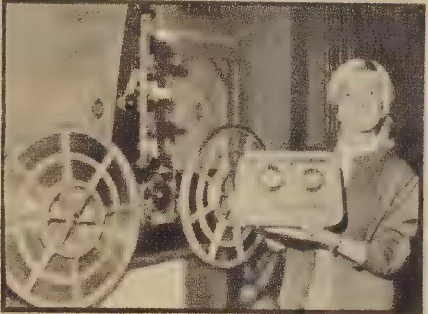
If we endeavour to trace the definite beginning of magnetic recording we find that, although credit for building the first magnetic recorder belongs to Valdemar Poulsen, there are indications that others had thought of the idea before Poulsen.

One of several references to magnetic sound recording may be found in "The Electrical World" of September, 1888. An article in this issue by Oberlin Smith tells of his developing "a successful machine for spinning metallic dust into a cotton cord on which sound might then be recorded." Like so many other experimenters, however, Smith did not press on with his invention and it was left to Poulsen, in 1898, to produce the first actual working model for a magnetic recording machine.

Poulsen's early recorder consisted of a drum on which was wound steel wire a few millimetres thick. As the wire unwound from the drum it passed in contact with a magnetic "head" comprising two soft iron laminations in a coil. Magnetic impulses were transferred to the wire by the head laminations pressing against opposite sides of the wire.

The head was arranged to move along a path parallel with the drum, and the wire, being wound in spiral form on the drum, was used to propel the head.

There being no electronic means of amplification available at the time, the coil of the magnetic head was connected to a carbon microphone and a battery during recording and to a set of headphones for the playback. From the mechanical point of view the "Telegraphone," as Poulsen called his invention, was similar to Edison's phonograph, although it operated on much more advanced principles of recording and reproduction.



A 1930 magnetic recorder using steel tape. Developed by Dr Karl Stille it is similar to those used by the B.B.C. A modern tape recorder is shown for comparison.

Although Poulsen's invention enjoyed some popularity at the turn of the century, it never made any inroads into the domestic market because it required headphones for listening, whereas the gramophone, although of inferior sound quality, was a "loudspeaking" device. The gramophone was also a much cheaper device to produce and this has always been an influencing factor on the domestic market.

In addition, gramophone records, at least in disc form, were ideally suited to mass duplication by pressing, thus further reducing costs. Even today, this factor remains a major one in favour of the gramophone record as a medium for mass program distribution.

Poulsen's company eventually went bankrupt and magnetic recording was forgotten until 1919, when the recently invented valve led to a revival of interest. At this time Dr Karl Stille tried to adapt the "talking wire," as he called it, into a sound carrier for motion pictures. Experience showed, however, that photographic film recording was not only better in quality but also easier to use for the purpose; and the "talking wire" once more passed into obscurity, at least as far as a popular or domestic market was concerned.

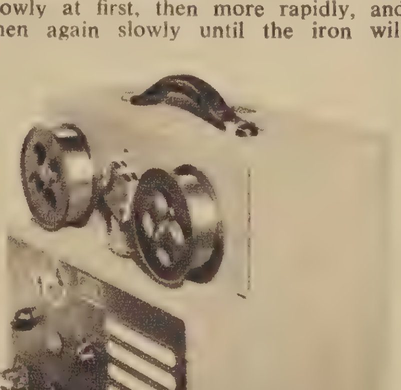
Magnetic recording continued to be developed by some companies, and was used extensively by the B.B.C., using steel tape as the recording medium. At the outbreak of World War II it was pressed into service by the armed forces as a means of recording high speed code transmissions for later replay at a slower speed.

During this period some very compact wire recorders were developed and used by the Allies. The Germans, in their turn, had developed a recorder using a plastic based, metallic oxide coated tape, very similar to that used in present day machines. Magnetic recording really "arrived" after the war and the art continued to develop to the high standards achieved today.

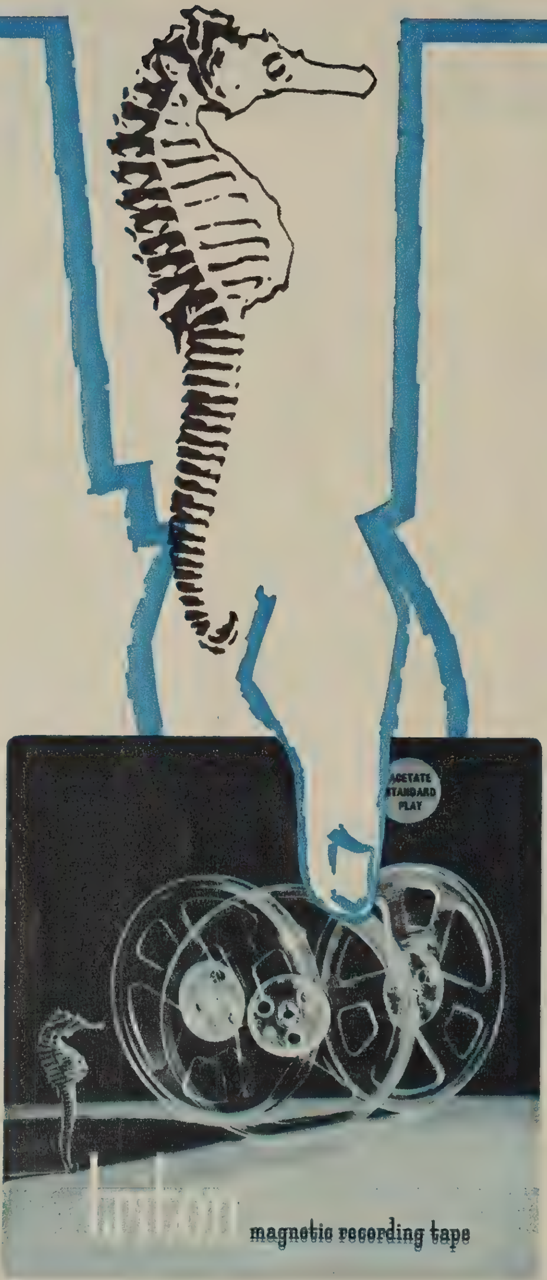
In order to understand just how magnetic recording works we will need to enlarge on some of the basic fundamentals of magnetism covered in Chapter Three of our course.

In this chapter we found that certain materials, namely iron and similar alloys and compounds, have the ability to concentrate magnetism within themselves. These ferrous materials are termed "ferromagnetic" and they are said to have high "permeability," permeability being the ratio of magnetic flux density produced in a material to the magnetic flux density that would be produced in air by the same magnetising force.

If we take a sample of unmagnetised iron and subject it to a magnetising force, we will find that the amount of magnetism induced in the iron will rise slowly at first, then more rapidly, and then again slowly until the iron will



A commercial wire recorder marketed about 1948. Wire recorders were not developed much beyond this stage.



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absorb no more magnetism, this latter state being known as the SATURATION point of the material. This process is shown graphically in figure 1.

Here we start at point "A", which represents zero magnetising force and zero induced magnetism, and apply a steadily increasing magnetising force along the "H" (Magnetising Force) axis, to the right of point "A." As we do, the induced magnetism which results is plotted along the "B" (Induced Magnetism) axis, giving rise to the curve "A"-"C"-"D"-"E".

From this graph we can see that only the middle section of our curve shows a reasonably linear relationship between magnetising force and induced magnetism, the sections from A to C and D to E being distinctly non-linear.

When the magnetising force is removed from the iron the induced magnetism in the material does not disappear entirely but, following a path other than that of its original magnetisation curve, it falls to a value which is a proportion of the original value. This is shown by the curve E to E', and the magnetism remaining in the iron is known as its "remanent" magnetism.

If we consider any value of induced magnetism along the curve A to E we will find that it will fall to a remanent value along a path which may be regarded as "parallel" to E-E'. Thus induced values C X D and E will produce remanent values C' X' D' and E' along the B axis. It is important to note that remanent values resulting from any induced values between C and D will be linearly spaced along the B axis, while those resulting from values from A to C and D to E will be non-linearly spaced.

The curve shown as A to E might typically be that created in our piece of iron by the "north" pole of a bar magnet or by current through a coil in a specific direction. If we had used the "south" pole, or caused the current to flow in the opposite direction, we would have created the curve A-J in the bottom left of the drawing. Note that the two curves, although of opposite polarity, are mirror images and both show the same degree of non-linearity at the beginning and end of their trace.

But note that the iron would only have followed the curve A-J had it been initially in the unmagnetised state. If we had simply applied our reverse magnetising force after first taking the iron up to E and then down to E', the curve followed would have been as shown by the dashed line. The induced magnetism would have gone directly from E' to J, as shown, and on removal of the reverse magnetising force it would have dropped to J'.

If we again applied a magnetising force, this time in the initial direction, the induced magnetism would pass from J' to E, and so on. Unless we demagnetise the iron, it will not return to the zero point A but simply swing around the "loop" EE'JJ', shown dashed. Such a loop is called a HYSTERESIS LOOP, and it will have a shape depending upon the type of magnetic material concerned.

In the first and simplest form of magnetic recorder produced by Poulsen, the recording head was fed with an AC signal at audio frequencies. This is shown in figure 2, where the head signal is shown as "Input Waveform" and can be visualised as swinging the magnetising force alternately left and right along the H axis. From this we can plot points of induced magnetism along the B-H curve, from these plotting remanence points along the B axis resulting from them, and, finally, extend these points to the right and use them to create a graph of the waveform which has been recorded.

As can be seen, this is badly distorted. The distortion comes from two sources, the non-linearity represented by G-A-C, which is called "crossover" distortion, and that represented by D-E and F-J, which is called overload distortion, or saturation.

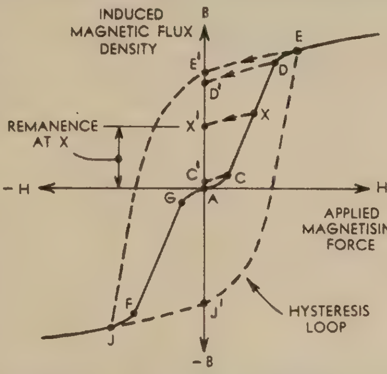

Figure 1: ***The curve of induced flux (B) plotted against applied magnetic force (H) for a magnetic material, showing initial and repeated magnetisation. (The BH curve).***

Overload distortion may be avoided by restricting the level of signal recorded, and this precaution must still be observed in modern recording systems; but there is no such simple solution for the crossover distortion problem, and this is the real limitation of such simple recording systems.

In an effort to overcome this distortion Poulsen introduced a simple form of biasing, known as "DC biasing," He achieved this by applying a voltage of fixed polarity to the recording head so that, without an input signal, a magnetising force approximately midway between points C and D was applied to the wire (figure 3). When an input waveform was applied along with the bias voltage it would cause the magnetising force, and therefore the induced magnetism, to swing from the centre point of the curve up toward D or down to C, depending on the polarity and amplitude of the signal. Subsequently the remanent magnetism would range between C' and D'.

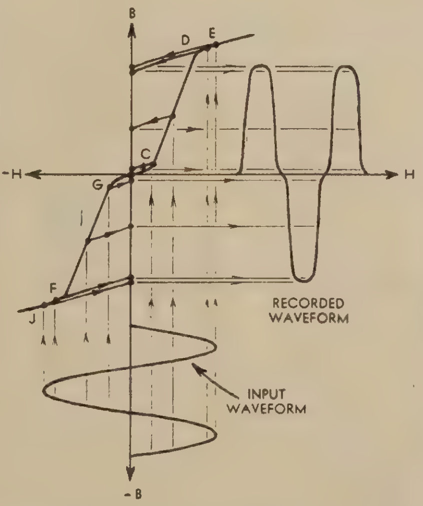

Figure 2: ***What happens if one attempts to record an audio signal without any form of bias. The non-linearity of the B-H curve causes distortion at both the zero-crossings and peaks of the signal.***

The important thing about the introduction of "bias" was the fact that it allowed magnetism to be induced in the wire over the substantially linear portion of the curve. The distortion introduced by the previous method was therefore reduced to a minimum.

The use of DC bias in this fashion allows quite faithful recordings to be made, and many early tape and wire recorders used this system. It is still used to the present day in battery-operated recorders of the cheaper variety.

The main disadvantage of DC biasing is that recordings made in this way are noisy; they have a very poor signal-to-noise ratio. The noise level is high because the steady bias remanence recorded on the tape along with the signal tends (for complex reasons) to accentuate noise due to the unevenness and granularity of the magnetic coating of the tape. Also the signal level is lower than one would like, because DC biasing uses the linear section of only one side of the B-H curve; the other section is virtually wasted.

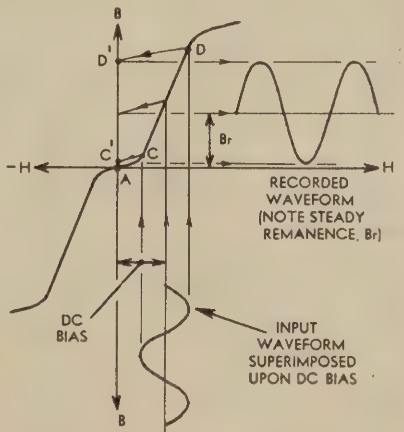
B
D'
D
C'
C
Br
-H
H
A
RECORDED WAVEFORM (NOTE STEADY REMANENCE, Br)
DC BIAS
INPUT WAVEFORM SUPERIMPOSED UPON DC BIAS
B

Figure 3: ***The principle of DC biasing. The DC bias is arranged to give an "operating point" halfway along one of the linear sections of the B-H curve, giving distortionless (but noisy) recording.***

The system of biasing which is used in all modern recorders (except the cheaper battery machines) produces recordings having a considerably better signal-to-noise ratio than DC biasing, by using as bias an AC signal of supersonic frequency. Let us now see how this SUPERSONIC BIAS system works.

Let us first consider no-signal conditions—the case where we have no audio recording signal. Under these conditions the recording head of a recorder using supersonic bias has applied to it a current alternating at a supersonic frequency —usually from 40 to 100KC.

The effect of this current is to produce in the head gap and the tape passing over it a magnetic field reversing at the same extremely rapid rate. The amplitude of the bias current is arranged so that the **peak** value of the magnetic flux density experienced by the tape immediately

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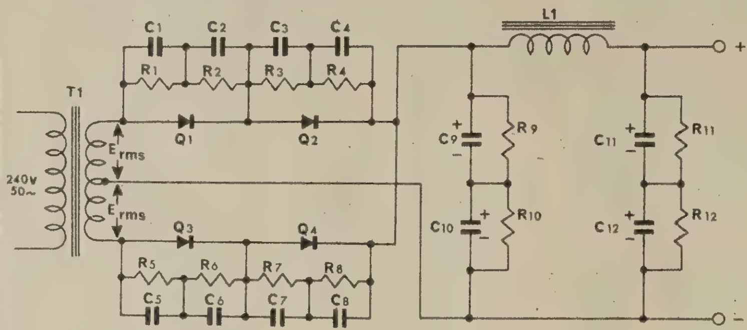

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T1	350-0-350 V at 200 MA A & R PT1938 VO=490 V.DC 180 MA 385-0-385 V at 250 MA Ferguson PF171 VO=500 V.DC 230 MA 400-0-400 V at 250 MA Trimax TP4327 VO=520 V.DC 230 MA
Q1-Q4	Anodeon IN3196 800 PIV Rectifiers

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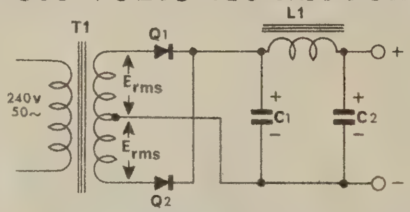

C1-C2	64 ufd 525 V.W.
L1	12 Henry 150 MA (Ferguson CF108, A & R 3042, Trimax TZ465
T1	250-0-250 V at 150 MA (Ferguson PF1508, A & R PT1896)
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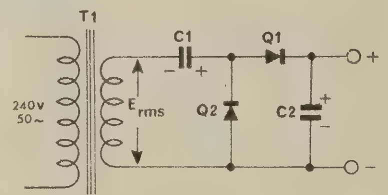
45 VOLTS 45 MA FOR BIAS SUPPLIES



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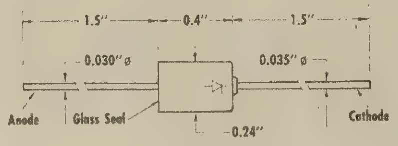

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Maximum RMS supply voltage	V	35*	70*	140*	210*	280*	350*
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D.F. Forward current at 75°C	MA	500*	500*	500*	500*	500*	500*
Recurrent surge current	A	6	6	6	6	6	6
One cycle surge current (50 cps)	A	35	35	35	35	35	35
Max. Forward voltage drop at 500 mA	V	1	1	1	1	1	1
Max. rev. current at rated PIV and 25°C	UA	5	5	5	5	5	5
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This procedure results in the state of affairs suggested by figure 4. As the tape approaches the recording head gap, and enters the field, it is swung through a number of rapid flux alternations, passing through a series of expanding hysteresis loops (not shown) until it is swung through the loop MNOP directly over the gap. M and O are points halfway up the linear portion of the B-H curve of the tape oxide in each direction.

When the tape moves away from the head gap, it is swung through a further series of alternations, but this time they are decreasing in amplitude. Thus, as figure 4 shows the tape passes through a series of decreasing hysteresis loops. It ends up at a point which is virtually at the intersection of the B and H axes—i.e., with zero remanence.

In other words, the net effect of the high frequency bias signal itself is virtually zero. Now let us consider what happens when we superimpose upon the bias signal our audio recording signal. Figure 5 should help in understanding this.

At the bottom of the diagram is shown the audio signal superimposed upon the supersonic bias signal. Above this is shown the hysteresis loop corresponding to zero signal amplitude, marked A (solid line); the loop corresponding to the time BB', when the audio is at maximum amplitude in one direction, marked B (dashed line); and the loop corresponding to the time CC', when the audio is at maximum amplitude in the other direction, marked C (dotted line).

Note that the loops shown correspond to the tape directly over the recording head gap. In each case there will be an expanding and contracting series of loops as the tape approaches and moves away from the gap. These have been omitted to preserve clarity.

As may be seen the effect of the audio signal is to "wobble" the hysteresis loop of the bias either side of zero, and providing the amplitude of the audio signal is kept below the level where the tips of the loops reach the saturation "knee" of the curve in either direction, this wobbling will be quite linear. The movement of the loop will follow faithfully the audio signal waveform.

Because the movement of the loop is linear, the nett remanence produced by the loop will also be linear. Thus, although the AC bias alternations themselves produce no recording, the tape is left with a recording of the audio signal which is a faithful replica of the original. The recording represents the nett remanence of the linearly wobbled loop.

The effect of supersonic AC bias is thus to make the effective B-H curve of the tape oxide material quite linear around the zero-remanence point. This is suggested by the small diagram at the right of figure 5, which shows the actual B-H curve and the effective curve produced by using supersonic bias.

Before a recording is made, of course, the tape must be wiped clean or ERASED of any previous recording. This can be done by either passing the tape close to a permanent magnet or electromagnet, or by passing it over the gap of a head similar to the recording head but fed purely with a supersonic alternating current.

With the first of these methods, called "DC" or "permanent magnet" erasure, the tape oxide is taken into saturation in one direction (i.e., past E or J); when it leaves the erasing field it simply drops back to either E' or J.' This leaves it with a steady remanence only — although on replay the tape will sound very noisy for the same reasons which make DC biasing noisy.

The second method is the one used in most modern recorders, and is the logical method of erasure where supersonic biasing is used. As we saw from figure 4, a head fed solely with supersonic AC simply forces the magnetic oxide through a series of expanding and then contracting hysteresis loops, leaving it finally at A with zero remanence (or close to it). A supersonic erase head thus erases by taking the oxide through a series of loops until it saturates in both directions, and then back through another series of loops to zero. As with supersonic bias, this gives a very low noise level, and supersonic erase gives a very "clean" tape for new recordings.

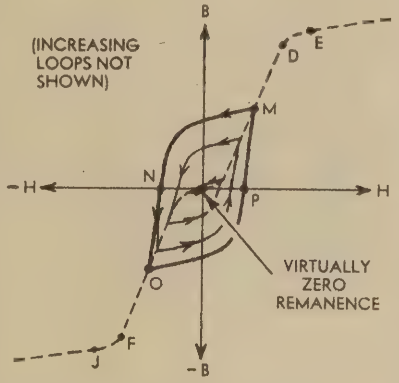

Figure 4: The effect of supersonic AC bias alone. As it passes the recording head gap, the oxide is swept through first an increasing series and then a decreasing series of hysteresis loops.

Having thus explained the manner in which a magnetic recording is induced in a wire or a metallic oxide coated plastic tape, we might now investigate some of the properties of the actual recording material.

In the earliest recorders produced by Poulsen and others, the recording material was either a steel wire or tape of approximately 1/16in thickness. In order to obtain a reasonable frequency response with the fairly wide head gaps then used, this wire was transported past the head at the relatively high speed of 80 inches per second.

It takes little imagination to see that this thick wire posed difficulties in mechanical handling and, even when large spools were used, yielded very short playing times. Recording wire was eventually refined, however, to a thread of 0.003in diameter, made from stainless steel and able to withstand a pull of approximately three pounds.

In the later stages of development, recording wire was considered, in many respects, to be superior to oxide coated tapes of the type used today. The wire then developed would stretch less than tape, was relatively immune to the effects of extreme temperatures and humidity, and was much more compact, for a given playing time, than any of the plastic tapes then produced.

It has been said, in fact, that wire would be an almost perfect recording medium were it not for three inherent faults. First, since it is round, it tends to twist and therefore the parts in contact with the recording head may be twisted around when the wire is played back. The result is a deterioration, often quite severe, in the quality of the reproduced sound.

Secondly, one recorded layer in intimate contact with another causes magnetic "print through" and this leads to echoes and a much higher background noise level than that of tape. The third fault is that wire cannot be as easily edited as tape, since good knot-tying in thin wire requires more dexterity than many people possess.

The development of metallic oxide coated paper and plastic tapes occurred at around the same period in the history of magnetic recording, but the paper tapes soon fell from favour because of various inherent faults which they possessed.

The unwanted sound, or noise, that any coated tape produces is caused mainly by two factors (a) the lack of uniformity in the size and distribution of the tiny needle-shaped particles of ferric oxide in the coating, and (b) the roughness of the surface of the base material.

Since even the finest grade of paper

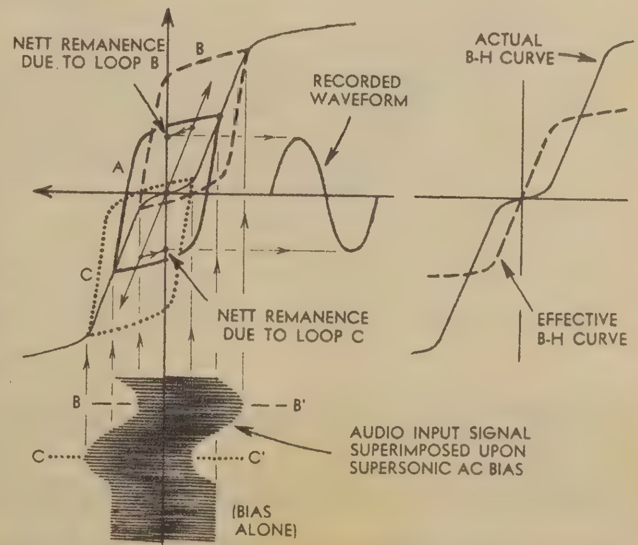
NETT REMANENCE DUE TO LOOP B
B
RECORDED WAVEFORM
ACTUAL B-H CURVE
A
C
NETT REMANENCE DUE TO LOOP C
EFFECTIVE B-H CURVE
B
B'
C
C'
AUDIO INPUT SIGNAL SUPERIMPOSED UPON SUPERSONIC AC BIAS
(BIAS ALONE)

Figure 5: Recording an audio signal using supersonic AC bias. The audio "wobbles" the supersonic hysteresis loop up and down the linear sections of the curve, giving faithful recording.

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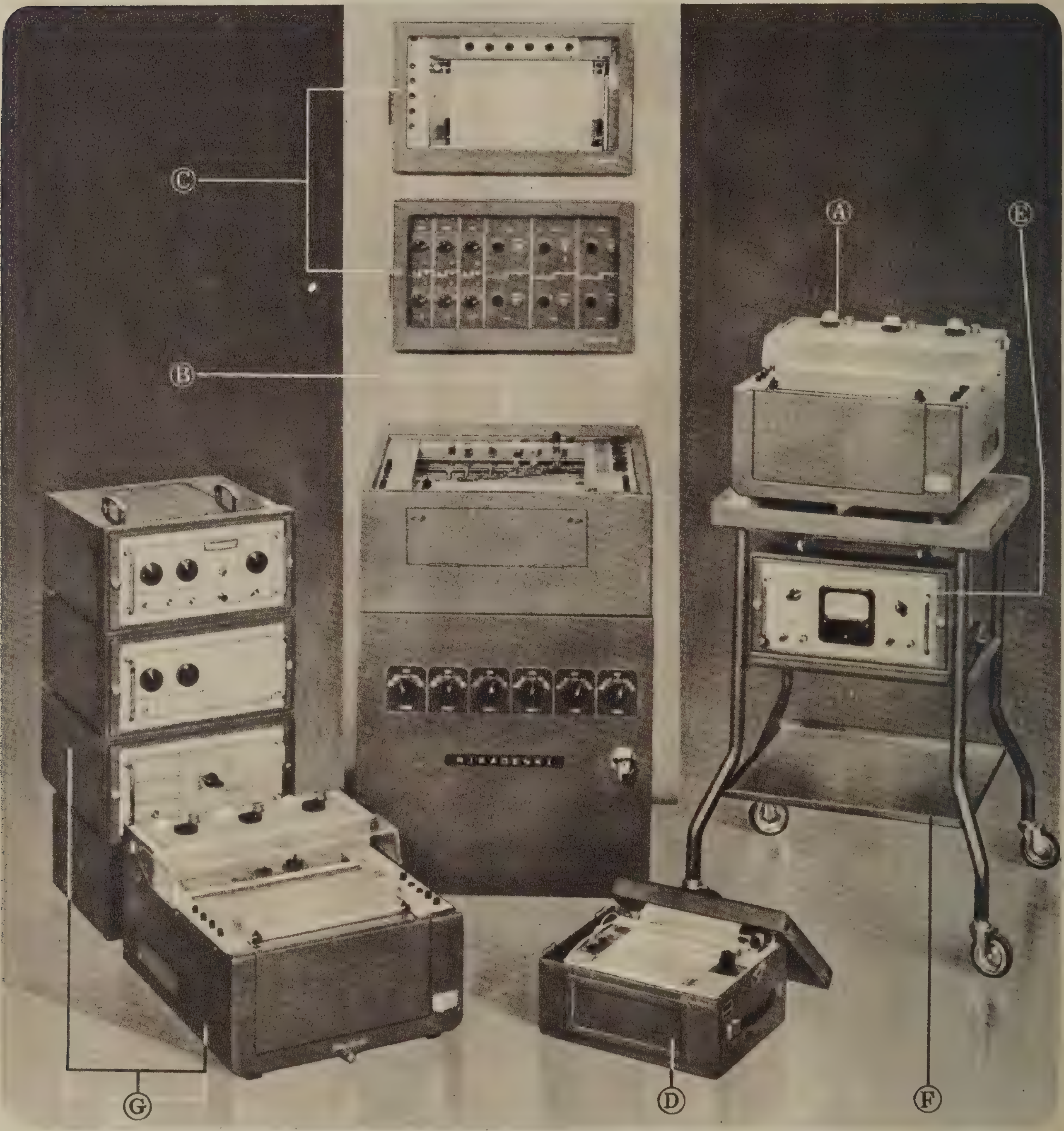

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has a noticeable "grain," it would, when coated with a magnetic oxide, have "hills" and "valleys" in its thickness and these irregularities will produce noise in spite of the fact that the outer surface of the oxide coating may, to all intents and purposes, appear to be perfectly smooth.

Paper-backed tape was, to be sure, quite a deal cheaper than the plastic tapes and it did have good dimensional stability but the disadvantage already mentioned plus the fact that it tore easily and deteriorated rapidly under adverse (very humid) storage conditions soon precipitated its downfall in favour of the plastic tapes used almost exclusively for magnetic recording today.

When plastic tapes were first developed, they were of two basic types—homogenous and coated. The homogeneous tape, as the name implied, consisted of a plastic material with ferric oxide particles dispersed evenly throughout the body of the material.

This tape never really achieved any popularity because not enough oxide to permit good quality recording could be mixed with the plastic without excessively weakening the material.

The first really successful tape was the "coated" variety, originally developed in Germany by Fritz Pfleumer. This tape consisted of a cellulose acetate base to which a thin coating of ferrous oxide was glued. At a later stage, but still in the years prior to World War II, polyvinyl chloride (PVC) was used as a tape base. This material was extremely pliant but had the disadvantage of stretching rather badly in use.

When first developed the coated tapes were inferior in performance to the steel tapes then in use, though much cheaper. Even at the outbreak of World War II very little had been heard about them, and the Allies continued to develop and use fine steel wire.

It was only after the war, when the Allies overran Germany, that it was discovered that the German scientists had developed tape and tape recording to a very high standard; a standard which put it far ahead of wire techniques of the day.

Today the wire recorder has virtually passed into history, tape having proved superior in all important respects. Extended playing time in particular, once a feature in favour of wire, has been markedly improved in recent years.

Thus, whereas some early tape machines ran at tape speeds as high as 30 inches per second, many modern machines run as low as 15/16ips and still offer a quality of reproduction perfectly adequate for many applications.

At the same time, the development of thinner tapes, such as "double play" and "triple play," and the technique of putting two ("half") tracks or four ("quarter") tracks on the one tape have also contributed.

As a result many hours of recording can now be packed onto quite small reels of tape. For example, a five-inch reel will hold 1,200 feet of double play tape which, if used with a half track head at 15/16ips, will provide four hours playing time in each direction, or a total of eight hours. And this is without considering quarter track recording and/or triple play tape.

Today, tape is the recording medium in a wide range of applications. It is used as the "master" for gramophone records, for motion picture recording, for recording sound in broadcast studios, and sound and video in TV studios.

Tape recording is also used in a wide range of other applications, from computers to office dictaphones. Portable tape recorders are used extensively as "talking note books" by students, by reporters, by storemen for taking stock, by engineers checking large works, etc.

Typical of these is the situation illustrated in the photograph. Here an engineer for the British Railways is shown using a miniature tape recorder—small enough to hold in the hand—to record comments as he examines the overhead wiring on a new electrification scheme.

Previously, this was a two-man job; the engineer, and a clerk to take down his comments. And, since such inspections must normally be made during slack periods, they usually involved weekend work—at penalty rates.

Also, wet weather and damp locations, such as tunnels, made note taking a difficult job, adding further to the time needed for a complete inspection.

Now, with a portable tape recorder the engineer can do the whole job himself, even in wet weather. For such adverse conditions, the recorder can be carried in the pocket and used with a remote control microphone.

Our next chapter will have more to say about modern tape recorders. ■

This pocket tape recorder, made by Fi-Cord of Switzerland, is typical of the present state of the art. Because of the convenience they afford, these devices are finding wide acceptance in industry, education and commerce.

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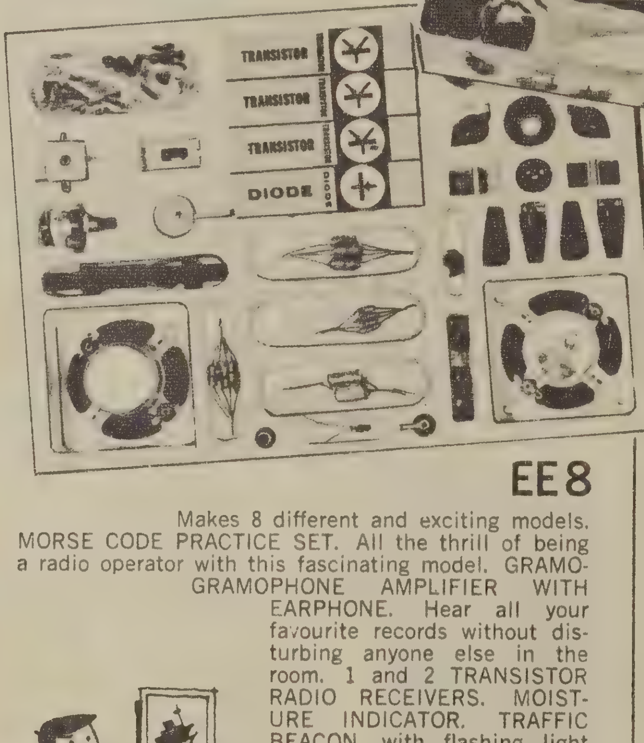

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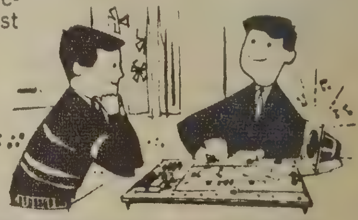

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A NEW *Playmaster* PROGRAM SOURCE

The knob on the right is for tuning, that on the left for selectivity. The centre knob, in the version for broadcast band only, can operate an off-on switch, wired either in the mains or heater circuit, according to the power supply arrangements. The front panel as pictured was mocked up from white card without any pretence to a commercial finish.

Described in the following article is an AM tuner intended for use with existing high-fidelity amplifier systems. The design provides two steps of selectivity with optional features including tuning indicator, in-built power supply, 10KC whistle filter and short-wave coverage. It can be built into a furniture-style cabinet or housed in a free-standing metal box.

By Michael Meechan and Neville Williams

A DECADE or more ago, readers attached considerable importance to AM radio tuners and we were faced with demands for a variety of designs with the emphasis on high RF performance, extremely wide bandwidth characteristics, shortwave coverage and so on.

More recently high fidelity enthusiasts have tended to rely on disc and tape recordings for most of their music and the demand for tuners, particularly of the more elaborate type, has diminished accordingly. Evidence of this reduced demand is in the fact that our relatively straightforward Playmaster "Program Source No. 2," described in April, 1961, has continued to satisfy most requests.

Another factor affecting the demand for separate tuners, is the popular trend towards unit amplifiers with in-built tuner facilities. Our own Playmaster 106, 107 and 108 units are examples of this approach.

In point of fact, the Program Source No. 2 would probably have continued indefinitely to meet readers' requirements for a separate tuner, had it not been for the fact that the pre-assembled dial has become virtually unobtainable. Kit sellers have sustained the position, for some time, by assembling dials themselves from the original stocks of bits and pieces but, as far as we can gather, the bottom of the barrel has just about been reached.

The only logical course, therefore, was to bring out a new tuner using, not a prefabricated dial unit, but one which is built up as part of the assembly—as in the Playmaster 106, 107 and 108 units already mentioned. Firms interested in selling these kits appear to have made adequate arrangements to obtain the necessary dial parts.

While we were at it, we decided that we may as well make the new tuner —or Program Source—as versatile as possible so that constructors could put in or leave out facilities to suit themselves. For the most part, this involved careful planning of the layout with a view to accommodating the various options on the one standard chassis.

The basic tuner circuit is exactly the same as for the Program Source No. 2 —a two-valve superhet with a semiconductor diode for detection and AGC. A simple switching operation allows the second IF transformer to be rendered substantially inoperative, thereby reducing sideband cutting on stations which are sufficiently strong and in the clear to allow this to be done. We shall need to mention a few points, later, about the basic circuit.

The "options" as mentioned in the introduction, can be summarised as follows:

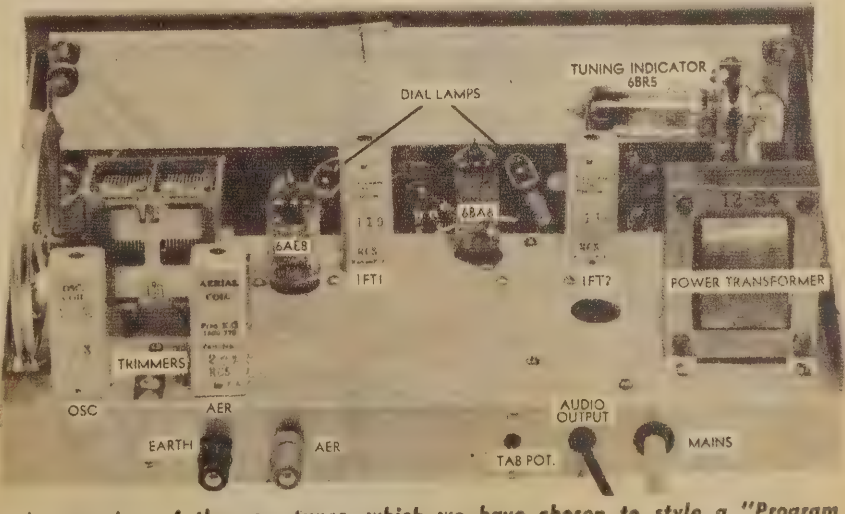
TUNING INDICATOR: An ordinary "magic eye" type indicator can be added, visible through a cutout in the dial face, exactly as in the Playmaster 108 unit. Alternatively there is room, in about the same position, to mount one of the little rectangular perspex meters which are currently being sold quite cheaply around the trade.

POWER SUPPLY: Most basic amplifiers, including Playmaster units, have the necessary margin of high tension and heater current to operate an attached tuner. Where this is not so, or where it is physically inconvenient to obtain power from the amplifier, an in-built power supply can be provided.

WHISTLE FILTER: Australian broadcast stations operate on channels 10KC apart and the carrier from a distant transmitter may heterodyne the wanted carrier to produce a 10KC audio resultant. Whether this is heard depends on the strength of the interfering signal, the overall high frequency response of the receiving system and sensitivity of the listeners' ears to this quite high frequency. If 10KC whistles are a problem, they can be eliminated by a sharply tuned filter without any apparent effect on audio signal quality. How to fit the whistle filter will be described next month.

SHORT-WAVE RECEPTION: This poses a number of problems, including layout, complexity of wiring, cost and the availability of suitable coils. As yet, we have not wired the dual-wave facility into the tuner, but we have sought to provide for it in the chassis layout. We shall be looking into this, also, next month.

OUTER CASE: The new Program Source fits the same case as the earlier Program Source No. 2, being the case originally produced for the smaller of our Unit amplifiers. It measures 4⅝ inches high, 12½ inches wide and seven inches deep. Where the tuner is to be mounted into a furniture style cabinet



A rear view of the new tuner, which we have chosen to style a "Program Source." Putting the broadcast band coils at the rear leaves room for the possible addition of short-wave coils. The vacant valve hole envisages the addition of a whistle filter stage.

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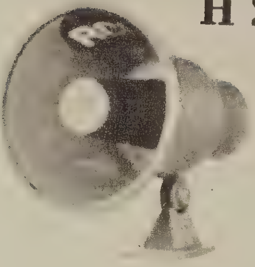

H 210

Low frequency cut-off	350 Hz
Sound distribution	90°
Air column length	510 mms.
Maximum diameter	225 mms.
Maximum length	275 mms.
Weight	1,100 kgs.

Power rating	12 watts
Watts peak	25 watts
Voice coil impedance	16 ohms
Frequency response	150-6.500 Hz
Maximum diameter	82 mms.
Maximum height	60 mms.
Weight	790 grs.

Complete with accessories for application of line transformer.

H 300

Low frequency cut-off	220 Hz
Sound distribution	90°
Air column length	550 mms.
Maximum diameter	315 mms.
Maximum length	365 mms.
Weight	1,500 kgs.
Power rating	18 watts

Watts peak	35 watts
Voice coil impedance	16 ohms
Frequency response	120-7.000 Hz
Maximum diameter	82 mms.
Maximum height	68 mms.
Weight	1020 grs

Complete with accessories for application for line transformer.

H 800/s

Low frequency cut-off	85 Hz
Sound distribution	65°
Air column length	1740mms.
Maximum diameter	825 mms.
Maximum length	920 mms.
Weight	16 kgs.
Power rating	25 watts
Watts peak	45 watts
Voice coil impedance	16 ohms

Frequency response	80-12.000Hz
Equalized compression system	
Maximum diameter	88 mms.
Maximum height	70 mms.
Weight	1200 grs.

Complete with accessories for application of line transformer.

Price on application.

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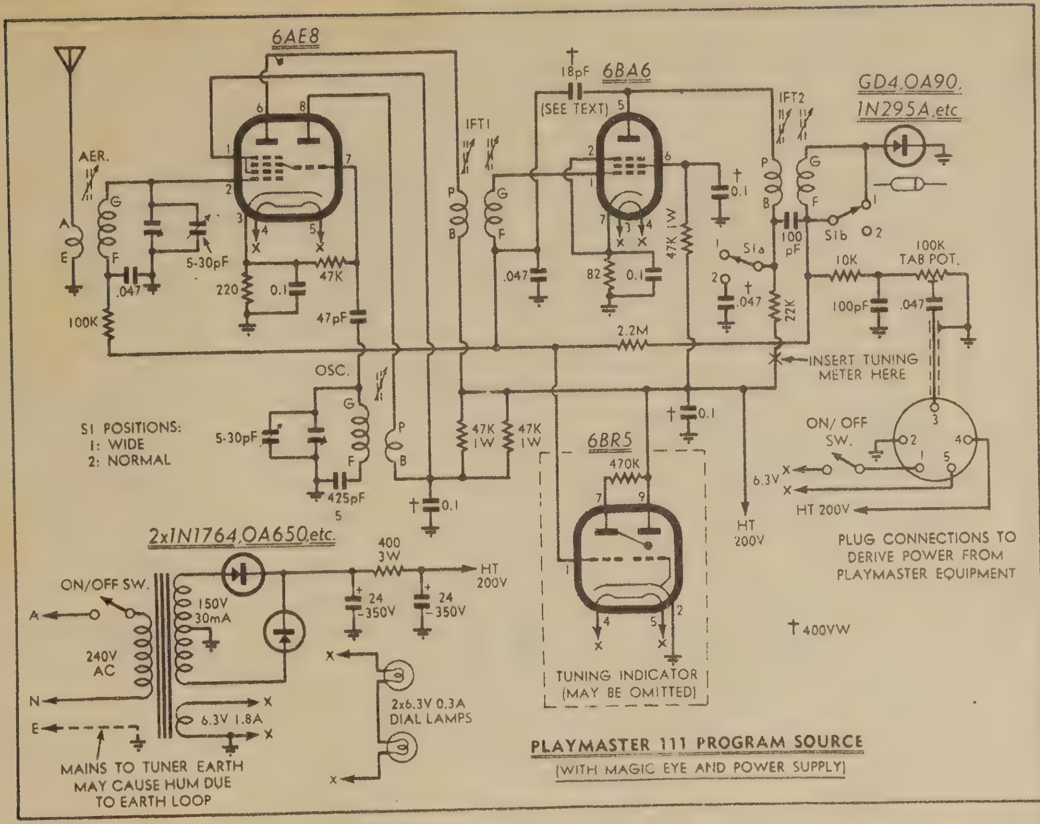


The basic circuit diagram with optional power supply and magic eye tuning indicator. If a tuning meter is used, it should be wired in series with the IF amplifier plate supply in the position shown and shunted back to between 5 and 10mA FSD so that it is fully deflected with no input signal. See text regarding earthing arrangements for the heater wiring.

the panel can simply show through a suitably dressed cutout, the metal case then being unnecessary.

Turning back to the basic circuit, this involves a 6AE8 as the frequency changer, with a quite conventional set of supply components.

You will need a standard aerial and oscillator coil—intended for valves, not transistors — and the oscillator coil should be of a type to suit the 6AE8.

It will simplify matters if the coils are chosen to suit the cutouts in the chassis, but, otherwise, the brand does not matter. Before mounting the coils, take careful note of their connections.

Much the same remarks apply to the IF transformers. They should suit the chassis cutouts, they MUST be for valve circuitry, and they should be suitable for a single-stage IF system.

The circuit operates with normal gain and selectivity with the levers of S1a and S1b in position 2.

In these circumstances, the "B" connection of the second IF transformer is bypassed to chassis and the primary winding provides the normal resonant plate load. At the same time, the 100pF capacitor attached to the "F" lug of the secondary effectively bypasses this point also to chassis, through the .047 primary winding bypass.

Thus IFT2 operates in the normal fashion, providing a double-tuned coupling circuit between the IF amplifier valve and diode detector.

With S1a and S1b in the alternative positions, as drawn, S1a opens the bypass circuit from "B" to chassis, so that the plate load for the IF amplifier is formed by the primary winding and a 20,000 ohm resistor in series. However, the resonant qualities of the primary are negated by the fact that the IF secondare winding is shorted by S1b.

Thus the IF amplifier operates, virtually, into a 20,000-ohm resistive load, being coupled to an untuned detector circuit through a 100pF capacitor and the internal stray capacitances of the IF transformer.

Under these conditions, selectivity is reduced and high frequency response is improved due to the increased bandwidth. Gain also suffers, of course, but it is assumed that the facility is most likely to be used on local stations, with ample signal strength to compensate.

In terms or ordinary broadcast receiver practice, the 6BA6 has higher gain than most other IF amplifier valves and this may lead to instability when the IF system is switched for normal

PARTS LIST

1	**Chassis 12in x 6in x 1¼in.**
1	**Case (Optional); internal dimensions, 12¼in x 4½in x 6½in deep.**
1	**Front Panel.**
1	**2-Gang tuning capacitor, (Roblan or similar).**
1	**Miniature aerial coil.**
1	**Miniature oscillator coil.**
2	**Miniature 455KC IF transformers.**
1	**2-pole 2-position switch.**
1	**1-pole 2-position switch.**
2	**Trimmer capacitors, (Ducon type CWA 5-30, or similar).**
2	**9-pin miniature valve sockets.**
1	**7-pin miniature valve socket.**
1	**100K tab pot.**

RESISTORS

1	**82 ohm ½ watt.**
1	**220 ohm ½ watt.**
1	**10K ½ watt.**
1	**22K 1 watt.**
1	**47K ½ watt.**
3	**47K 1 watt.**
1	**100K ½ watt.**
1	**470K ½ watt.**
1	**2.2 meg ½ watt.**

VALVES, DIODES

1	**6AE8**
1	**6BA6**
1	**6BR5 tuning indicator.**
1	**0A90 germanium diode, (or similar).**

CAPACITORS

3	**.1 mfd 400v paper.**
2	**.1 mfd 100v paper or ceramic.**
1	**.047 mfd 400v paper.**
3	**.047 mfd 100v paper or ceramic**
1	**425 pf mica 5pc (padder).**
2	**100pf ceramic.**
1	**47pf ceramic.**
1	**18pf ceramic.**

DIAL PARTS

1	**Dial drum 3 7/8in in diameter, with ¼in spindle hole.**
1	**Dial glass to suit drum, (6¼in span), 10in x 1¾in overall.**
1	**¼in dial spindle, 4ft Nylon cord, spring and pointer.**
5	**Pulleys, 6 only ⅜in long bushes, 1 only ½in long bush. Metal for back plate (11½in x 2in), and 2 clamps for glass (¾in x ½in). Countersunk head metal thread screws of ⅛in diameter—½, ¾, 1, 1¼in long.**

SUNDRIES

1	**5-pin plug and cover.**
3	**Knobs.**
1	**8-lug, 1 7-lug and 1 4-lug tag strip, length of coaxial cable, hook-up wire, tinned copper wire, 2 dial lamps.**
2	**Terminals, solder lugs and solder.**
1	**⅜in rubber grommet, 12 solder. eyelets, washers, nuts and bolts.**

POWER SUPPLY

1	**Transformer, 150V, 30mA, 6.3V.**
2	**Silicon diodes, type IN1764 or similar.**
2	**24 mfd 350V electrolytic capacitors.**
1	**400 ohm 3-watt resistor.**
1	**8-lug tagstrip.**
2	**¾in and 1 only 5/16in rubber grommets.**
1	**Length of power flex and 3-pin mains plug.**

PEAK

A7 stereo amplifier
all transistorized

Specifications.

Frequency Response:

20-20,000 c/s ± 1 db

Power Output:

32 Watts per channel

Size: 13½″ x 5½″ x 10¼″ deep

Input Sensitivities

Magnetic pick-up	— 3.8 mV
Tuner, Tape Aux.	— 120 mV
Tape Monitor	— 330 mV

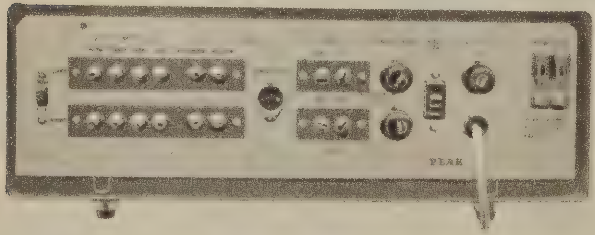
Tone Controls:

+ 13 db and — 15 db at 50 c/s
+ 15 db and — 20 db at 20,000 c/s

Equaliser: RIAA Curve

Scratch & Rumble Filters

Shipping weight: 18 lbs.



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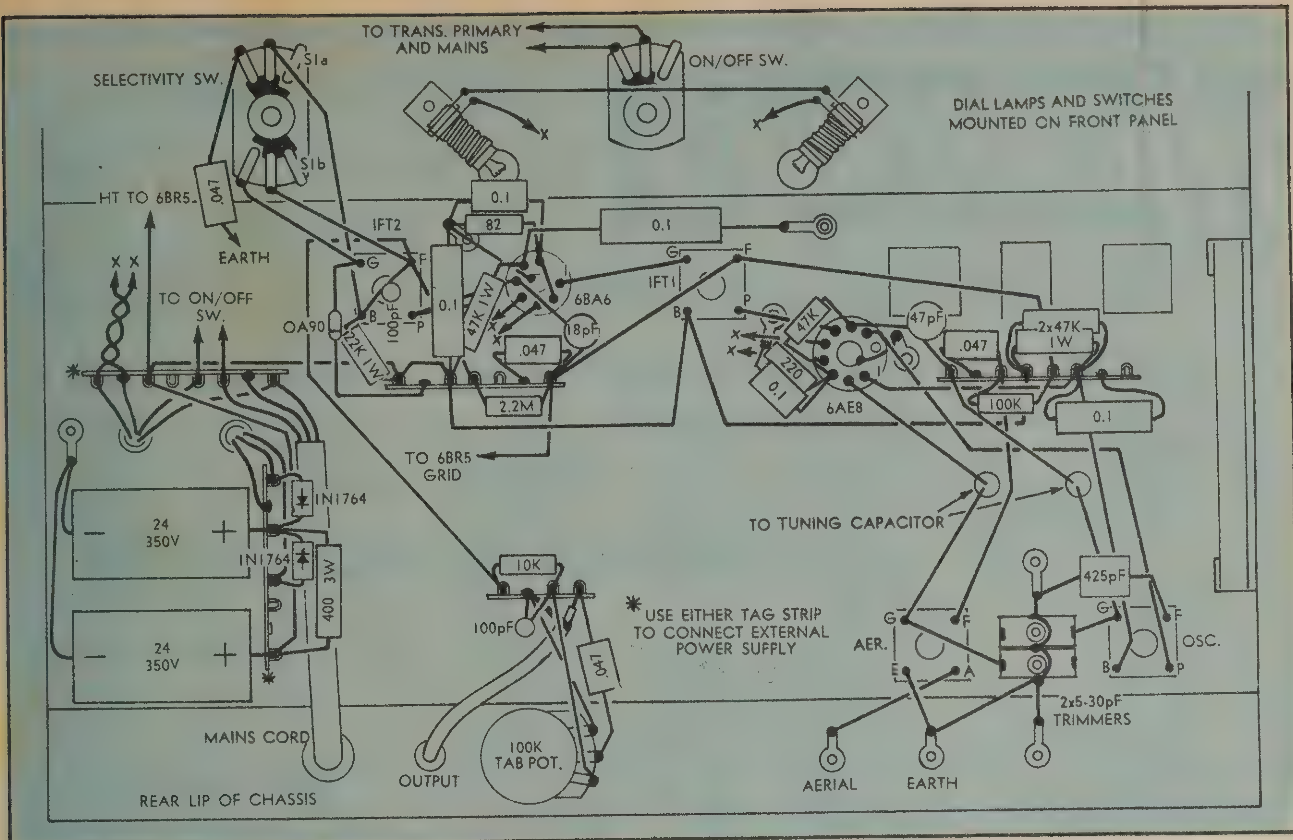


This under-chassis diagram shows the placement of the components and most of the wiring. Make sure that the coils and IF transformers are for a normal valve-type superhet tuner and check their connections before installing them in the chassis. They may or may not be the same as those used in our prototype. Keep all RF and IF signal leads short.

gain. This is evidenced by a whistle which varies in pitch as the unit is tuned across each station.

This tendency to instability can be readily controlled by the provision of a neutralising capacitor wired between the plate of the IF amplifier and the "F" lug of the No. 1 IF transformer. The specified value of 18pF proved to be quite satisfactory for the RCS transformers used in our prototype and is probably as good a value to start with as any.

Note that the presence and value of the neutralising capacitor affects the alignment, particularly of the IFT2 primary and the effect of the neutralising capacitor should only be judged on the basis of how the IF system behaves with the selectivity switched for "normal" and the transformers peaked with the particular value of neutralising capacitor in circuit.

If the neutralising capacitor is too small, the IF system will go into oscillation as any or all of the cores are brought to the peak of resonance.

If the neutralising capacitor is too large, the most obvious effects will be gross lack of sensitivity.

Apart from the switched selectivity feature, the detector/AGC circuit is fairly straightforward. Note, however, that the demodulated audio appears across a tab pot. and that the signal for the audio system is taken from the moving arm.

This is necessary because, on a strong station, the diode may deliver several volts of audio signal, whereas the audio system may not be able to accept more than a fraction of a volt without danger of overload. Much depends on the position in the system of the main audio gain control.

By fitting the tuner with its own potentiometer, the output level can be set very simply so that the tuner only delivers as much signal as the audio system can accept conveniently and/or without distortion.

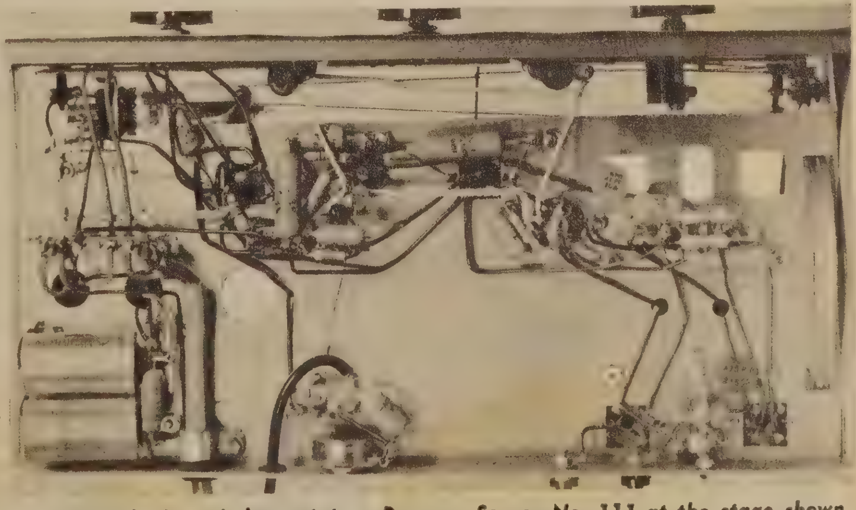
In the simplest case, the tuner can be operated from the power supply of the main amplifier. The circuit as drawn shows the supply leads wired to a five-pin plug, corresponding with the socket on the rear of Playmaster control units. In the more recent Playmaster basic amplifiers, such as the 101, practice has been to include the high-tension decoupling networks in the main amplifier chassis, routing the supply and signal leads to the control unit and thence to the tuner.

With some of the earlier Playmasters or in commercial amplifiers it may be necessary to rearrange the connecting leads and to provide a suitable high tension feed circuit.

Typically, the tuner may be operated with 200 volts on the high tension supply line, measured under no-signal conditions, the current drain approximating 16 milliamps. With signal, it will fall to about 9 milliamps.

For ordinary broadcast listening, the high tension supply may well be dropped to 150 volts, with a proportionate saving in current drain figures.

As a rule, it is best to feed the tuner from the main high tension line of the basic amplifier, since this is least likely



Underneath view of the prototype Program Source No. 111 at the stage shown in the circuit on page 53 — i.e. complete with magic-eye tuning indicator and in-built power supply.

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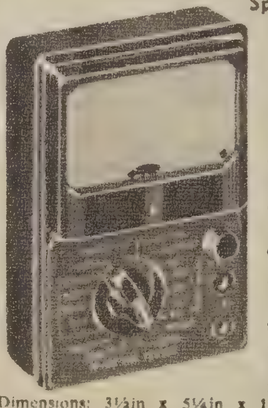
- 3in Meter.
- Handy pocketable size.



Specifications:
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AC Voltages: 0-10-50-250-500-1000 V (10,000 Ohms/V).
DC Current: 0-50uA, 0-5-50-500mA.
Resistance: 0-10K, 0-100K, 0-1Meg, 0-10-Meg. (62 Ohms, 620 Ohms, 6.2-K, 62K at centre scale.)
Capacitance: 0.0001uF-0.005-uF, 005uF-1uF.
Decibels: minus 20db to plus 36db in 2 ranges.

Dimensions: 3½in x 5¼in x 1⅜in.
Weight: 15oz approx.
Complete with internal battery, testing leads with prods.

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VU Meter	47/3
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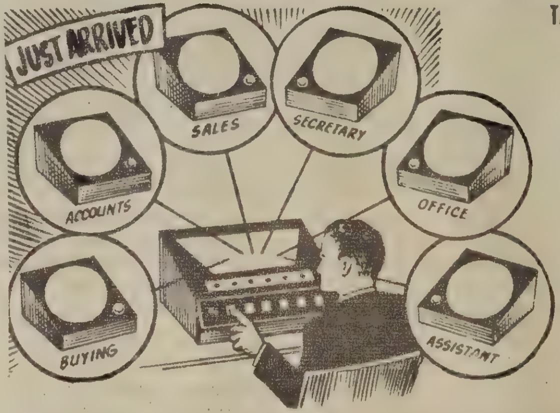

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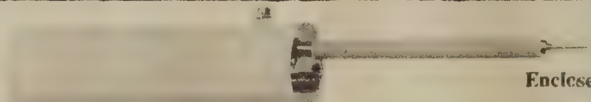

Enclosed in metal case.

SIGNAL INJECTOR MOD. SE250

Specifications
Oscillator: Free running type Multi-vibrator.
Transistor: 2SA-100 x 2 pcs.
Oscillation Voltage: 1.5—2V P—P.
Frequency: Between 400 to 700 c/s and its harmonics.
Dimension: 16mm dia. x 170mm.
Net weight: 80 grams (incl. dry cell).
Power source: Pen lite dry cell x 1.

51/9
Postage 2/.

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Hi-output type Twin Sapphires LP/Ster.—78 styli. . . . **19/6** each

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For Ronette 105 LP/Ster. 78 . . . **4/11**

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to affect the proportion of voltages within the amplifier. Depending on the source voltage and the figure at which it is desired to operate the tuner, a dropping resistor of between 1000 and 2000 ohms, rated at say five watts, would typically be required.

The resistor may or may not need to be bypassed at the tuner end with an electrolytic capacitor, depending on whether there is any tendency to hum or audio instability.

Special note should be taken of the heater circuit. If the heater supply is connected to chassis in the main amplifier or control unit, the wiring in the tuner should be kept free from the tuner chassis.

If the heater wiring is not otherwise grounded, however, it should be connected to chassis within the tuner. It is usually sufficient in this case to ground one side.

Turning now to the physical aspect, one immediate concern had to do with the number and arrangement of knobs. If the selectivity control had been treated as an option, as well it could, there might have remained only the tuning knob, looking very lonely on the front panel.

Even two knobs could look rather inadequate, so we settled for the three, as pictured—Tuning, Selectivity, and Off-on. While the latter is not strictly necessary, it serves a purpose in cases where, for long periods, the tuner may not be required. No less important, the third position becomes available for the wavechange function in a dual-wave version. But more of this next month.

Having completed our prototype, we became aware that certain mounting positions could be modified slightly to advantage and some minor dimensional changes will be made in the blueprint released to chassis manufacturers. However, the general layout as pictured can be followed and there should be no doubt about the placement of all the major components.

As with any kit, it may be wise to check through the components first, and the way they fit on the pre-punched chassis. Kit sellers do their best to ensure that parts and chassis dimensions correspond but things do get out of step occasionally. In general, it is much easier to file a slot or drill an extra hole while the chassis is still bare than when it is all but finished.

In assembling this new Program Source, the logical place to begin is with the dial and tuning mechanism.

If a tuning indicator is to be included it will be necessary first to cut a rectangular hole in the dial back plate, measuring 11/16in long x 9/16in high. It is placed ¼in down from the top and 2 3/16in from the lefthand side of the plate, viewed from the front. These measurements place the cut-out centrally between the end of the dial and the beginning of the stations marked on the glass.

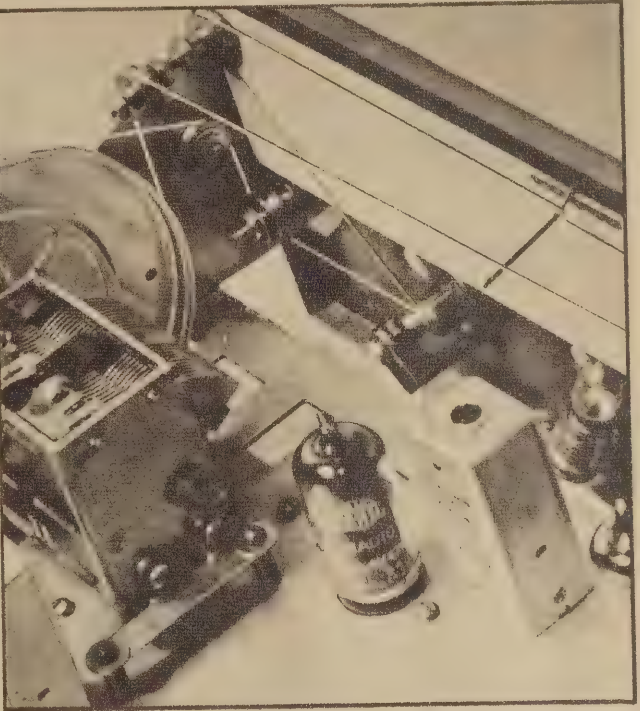
Be careful not to damage the paint while cutting the aperture, otherwise "touching up" will be necessary.

It will also be necessary to make up a bracket to hold the tuning indicator in position; this measures 1 1/8in wide x 1 3/8in deep, with a 3/8in lip along the 1 3/8in dimension, bent at right angles.

A ¾in hole must be cut out of the bracket to accommodate the 9-pin base for the indicator. Make sure that the socket orientation is such that the target area of the indicator is visible in the aperture and not pointing in any other direction.

The whole assembly is secured to the back plate by means of nuts and bolts which go through slotted holes in the 3/8in lip, the slotted holes allowing for some vertical adjustment to counter parallax.

The dial glass itself rests hard against the rear face of the front metal panel in a space created by cutouts in the bent-round chassis ends. Assemble the chassis to the panel and check to see that the glass will fit into the available space. If too tight, disassemble and file the metal as necessary.



This angle view of the chassis shows the stringing of the dial and, at right, one of the dial lamps. Visible also are the holes provided for short-wave coils and trimmers. A clear path has been left above and below the chassis for a possible crank system, from the centre knob position, to operate a slide type wavechange switch.

Check also the vertical positioning of the dial scale in the panel cutout. If too low, pack it up with a sliver of card or cork cemented against the bottom edge of the slot.

Small clips held under adjacent assembly nuts at each end of the glass hold it in place. Be careful how much pressure the clips exert on the glass, as too much may cause it to crack. With the glass in position, the rest of the dial and tuning system can be assembled.

Before fastening the tuning gang to the chassis, attach the necessary leads to the stator plates. The normal brackets are used to mount the two-gang capacitor in conjunction with four ½in spacers and ⅜in screws. The dial drum should be fitted to the gang before mounting and adjusted for free turning after mounting.

The dial backing plate, which doubles as a guide for the pointer slide, can be attached at this stage. Looking from the rear, the left-hand mounting bolt is 1¾in long while the one to the right is 1in long, both having countersunk heads. If the tuning indicator is to be used, the bracket and 9-pin socket should be fitted to the dial backing plate before it is mounted as above.

Two ¼in spacers separate the back plate from the panel, providing room for the pointer between the two. Two sets of bushes and pulleys are required on the left-hand bolt, while only one is needed at the right-hand side.

Reference to the dial mechanism photograph will reveal a fifth pulley attached to the side flange of the chassis. If drum and pulleys are correctly aligned, you will find that a ¼in bush used in this position will allow the cord to move along the outer edge of the drum, preventing the cords from rubbing.

The dial mechanism may now be strung, using, for preference, proper woven nylon dial cord.

A bit of tinkering may be necessary to get the drum properly positioned on the shaft so that the gang can be rotated through its full travel, while the pointer simultaneously moves across the scale. The cord, by the way, should make about three turns around the knob spindle.

Make sure that the spring is properly tensioning the cord and that the whole system works smoothly and without backlash. A small drop of oil on the pulley spindles may help. Needless to say, the dial system can be adjusted very easily at this early stage but not so easily later.

As will be apparent from the illustrations, two standard dial lamp holders were bolted against the inner side of the front panel, underneath the dial plate. It is suggested that the lamps be wired in series, since their full brillance is not likely to be required and their life, with 3 volts applied, should be very long indeed.

All bolts passing through the front panel should have countersunk heads, care being taken to see that they do not protrude above the surface of the metal. We expect that advertisers will make available decorative front plates in due course, as they have with other Playmaster units.

For the rest, it should be necessary only to refer to the wiring diagram.

If building the unit without its own power supply, the incoming leads from the 5-pin plug can be terminated on a tagstrip mounted in either of the positions under the power transformer site. The cord passes through the grommetted hole provided for the power cord.

The matter of alignment and the additional options mentioned earlier in the article will be discussed next month.

(To be continued.)

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As any serviceman will agree, the basis of profitable servicing is experience. Knowing that a certain set, with certain symptoms, automatically means a certain fault, enables the majority of jobs to be finished in a minimum of time. But such an approach has to be tempered with common sense, if one is not to be misled on occasions.

MY first story this month is a typical example. The set concerned was of well known make, and the particular model had been on the market for several years. One of its characteristics, from a servicing point of view, was that it seemed to suffer from more than its fair share of width troubles.

When it first appeared on the market, in the early days of TV and when most of us were still rather callow in this field, I encountered several of them which had lost width after about 12 months' operation.

In those days line output valves — the 6DQ6 in this case—were by no means above reproach. It seemed that the early versions had difficulty in coping with the very severe demands made upon them, and often packed up prematurely, at least by normal valve standards.

Knowing this, my first reaction was to replace the 6DQ6 and, in the first few cases, this seemed to be all that was necessary. Normal width was restored, including the usual amount of overscan, and I had no reason to suspect that anything else might be contributing to the same fault.

In fact, I'm still not sure about those early cases. It may well be that there was nothing else wrong with them but, in the light of subsequent events, I cannot help wondering. I became suspicious when I tackled one of these sets in the usual way and attained only partial success, forcing me to investigate more deeply.

The set was just like all the others, and suffering from the same lack of width. With more self-assurance than was justified I replaced the 6DQ6. Result; only a partial cure. There was a noticeable increase in width, but it still fell short of a full scan. It might have satisfied the customer for a while, but further deterioration of whatever was at fault, or simply a bout of low line voltages, would have had him back on my doorstep in short order.

Further investigation revealed the real culprit; a 3uF electrolytic capacitor across the self-bias resistor for the 6DQ6. When that was replaced the picture assumed normal proportions with no room for doubt. What was more, it retained its width, even when the old 6DQ6 was returned to the chassis.

I could only assume that, in this case at least, the new 6DQ6 was marginally better than the old one, even though the latter was still "good" and had plenty of useful life left in it, provided the rest of the circuit was functioning correctly.

Was this the case with the previous sets? Unfortunately, I never had a chance to find out, for they never came back. Whether this is a good sign or not I wouldn't like to say. However, if I did make a mistake, I can only plead ignorance, and add that there were a lot of my colleagues in the same boat at that time.

Anyway, thereafter I always went straight to the 3uF electro whenever one of these sets showed the slightest sign of width trouble and, over the years, I came to regard the fault as one which experience had made quite routine.

Thus it was that a recent call to one of these models, described as suffering from lack of width, failed to arouse any suspicions. I simply made sure I had a replacement 6DQ6 and a 3uF electrolytic and mentally budgeted for a routine job in the customer's home.

Alas for my complacency. When brought face to face with the set, in operation, I realised that I had a curly one. No one had thought to explain that the lack of width was not consistent. Sometimes the width was normal, sometimes it was mildly compressed, and sometimes it was quite bad. More important, though, was the habit it had of flicking quickly from one condition to another, now wide, now narrow, now hovering somewhere betwixt the two. No wonder the owner complained the picture was hard to look at.

So what was it? The 6DQ6? The electolytic? Or something quite different? I tried a new 6DQ6 first, as being easiest. The result was negative. Next I tried the electrolytic. This wasn't so easy, since I had to withdraw the chassis, but there seemed little doubt that it would have to come out anyway. Once again results were negative.

I made a tentative attempt to pin the trouble down by tapping likely components and areas of the chassis but the results were not very conclusive. It seemed that further attempts on this basis would only waste valuable time without much chance of success, I decided to take the chassis back to the shop.

With the set on the bench I went over the output stage in greater detail. A voltage reading on the 6DQ6 screen showed some flickering in sympathy with the width variation, but I couldn't be sure whether this was cause or effect. I tried a new screen dropping resistor and by-pass capacitor "on spec." but this did no good.

Adopting a more scientific approach I checked the waveform at the grid of the 6DQ6. Sure enough, the width variations were reflected in the amplitude. But were they due to a fault in the 6DQ6 circuitry, the coupling components to the previous stage, or the previous stage (a 12AU7)?

I removed the 6DQ6 and checked the waveform again. It still flickered. I moved back to the horizontal oscillator stage and found it still in evidence. I disconnected the lead from this stage to the cage and tried again. The oscillator output was now as steady as a rock. Whatever the trouble was, it was somewhere between the oscillator output and the 6DQ6 grid.

It didn't take long to track down after that. There weren't many components involved and the most likely one was the 200pF trimmer-like capacitor used to control the horizontal drive. I disconnected it and the trouble vanished.

Apparently the capacitor was suffering from some form of leakage, although I wasn't able to determine exactly what caused it. I washed it in methylated spirit and this seemed to cure it completely. Nevertheless, I decided to replace it, just to be on the safe side.

Which all goes to show that one can be too complacent about "routine" faults, and an ability to "pick them in one" based on experience. While a perfectly legitimate approach, and one on which successful and profitable servicing is based, it can provide a trap for the unwary.

In this case, I was possibly trapped on the first occasion because I assumed that what was probably true of the first job, was also true for those that followed. As a result, there is a very real chance that I made a wrong diagnosis before I became aware of the more subtle fault.

And on the second occasion I could have been similarly trapped, had not the fault been so obviously intermittent. (I never thought that a fault being intermittent would be an advantage.)

The moral: Unless you are quite sure that the fault you are working on is exactly the same as all the similar ones that went before, it will pay to take a second look.

My next story is on a completely different theme, and a rather unusual one as well. It involved a commercially manufactured amateur receiver; something which seldom finds its way into a service shop. On the other hand, the amateur fraternity as a whole seem to be tending away from the completely home-built receiver, prompted no doubt by the increasing complexity of any receiver designed to cope with today's crowded bands and various modes of operation.

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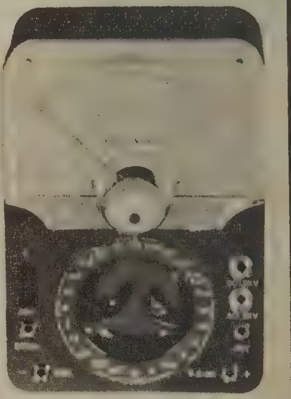

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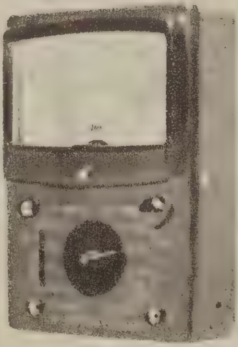

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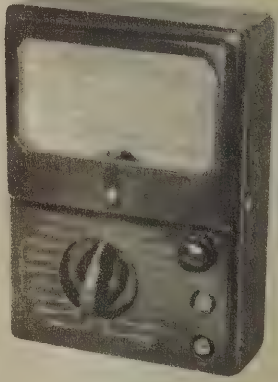

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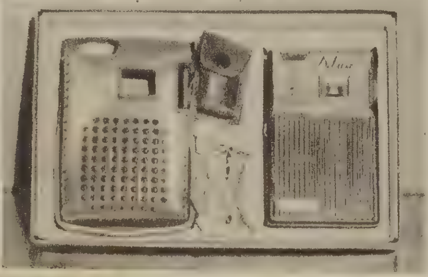

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o tackle one of these from the ground ıp.

Thus, those who can afford it, or are ortunate enough to score a "bargain" n some manner, are not too proud to ıse a commercial receiver. And, while here are those who criticise such an ıpproach as being "un-amateur," it nust be remembered that such a set is often little more than a place to start rom. Ahead of it will go various converters, to extend its range into the VHF and UHF regions, and making hese, and testing them, is itself a big enough task for many people whose spare time is limited.

Unfortunately, in treating the main eceiver as a "black box" the owner is n danger of ignoring its finer points. He may know its performance and capabilities well enough and be able to coax a readable signal out of the ast microvolt, but he may never have nore than glanced inside it, and be aken completely by surprise when it uddenly develops a strange fault.

Thus it was that my amateur friend called into the shop recently and rather sheepishly admitted that he had troubles in a commercial communications set. t was not so much that he had tried to ix it and failed, but that he hesitated o try. The main reason for this was hat the symptoms were difficult to interpret, and he did not want to start delving into the set at least until he was sure he knew what he was looking for. Even then, he felt he would like some moral support, on the basis, as he out it, that "two heads are better than one."

Perhaps it was some consolation to him when I had to admit that one of he heads might well turn out to be a 'sheep's head," since I had very little practical experience with equipment of his kind, and would have to find my way around from what I had read and what he could tell me. Assuming he was ready to accept these limitations, would do what I could to help.

Having reached agreement on this point, I inquired as to when he would ike to bring the gear over. Again he ooked sheepish. It just "happened" to be in the car outside. Together we ugged it in and set it up on the bench

As well as the receiver proper, there was a crystal-locked converter for the VHF bands, the receiver serving as a uneable IF in the vicinity of 6MC. It was while trying to work on the VHF bands that the trouble had first become obvious.

More precisely, the complaint was an inability to copy SSB signals on the VHF bands, the resultant signals being garbled and rough. My friend was not quite sure whether the trouble was all n the set, all in the converter, or perhaps a bit of each.

Using the shop's TV aerial we explored the VHF band. Fortunately, an SSB signal appeared shortly after we started and gave an excellent demonstration of the trouble. The signal was extremely "rough" and so badly garbled as to be quite unreadable. My mmediate impression was that hum was being introduced into the system somewhere, at a high enough level to break up the signal. My friend admitted hat he had the same impression.

At my suggestion we then disconnected the VHF converter and tuned o the 7MC band, where we were fortunate to find some more SSB signals. These were just as garbled. Well, at least that cleared the converter.

Since, according to my friend, the trouble appeared to be confined to SSB signals, it was natural to suspect the product detector/BFO section of the circuit. Fortunately, a circuit was available and we quickly established that this section used a 12AX7, with one half as the product detector and the other half as the BFO. Naturally, we tried a new 12AX7, but this achieved nothing.

Turning the chassis over we probed around the BFO/product detector section and finally isolated the coupling capacitor between them. We then disconnected the BFO from the product detector, switched the set to the AM detector, and coupled the BFO loosely into it. It was a rather crude arrangement, but it served to show that the signal was still badly garbled.

At this stage everything pointed to the BFO. I switched on the CRO — a wide range job normally used for TV — and fed the output from the BFO into it. As far as the CRO indicated, it was a pure sine wave, and there was certainly no sign of any hum content, such as might cause such behaviour.

As a final check, I disabled the BFO, then fed in a similar signal from the service oscillator. Result: garbled signals exactly as before. So that cleared the BFO.

Next, I tuned in a regular short-wave station, transmitting conventional AM signals. According to my friend's description of the set's behaviour, this

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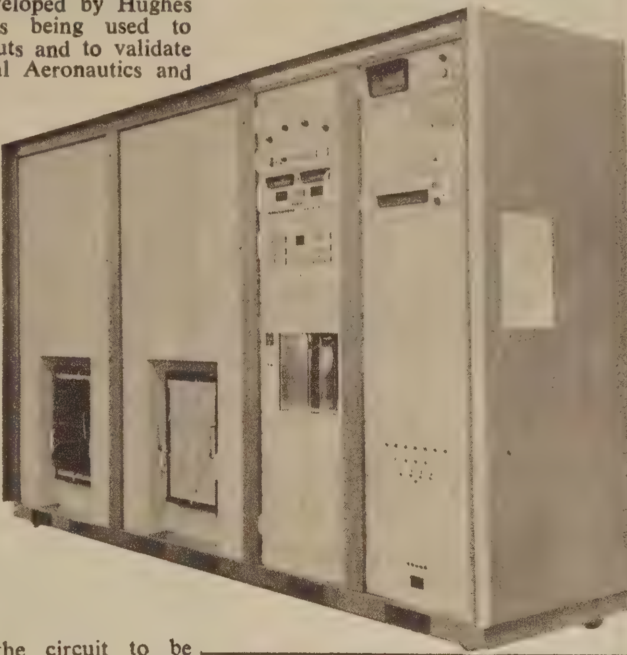

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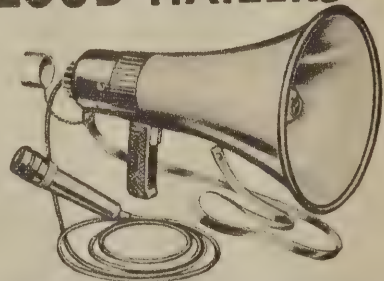

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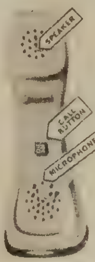

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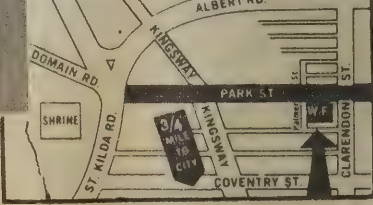

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should have been a clean signal. Relatively speaking, it was, in that it was one hundred per cent copyable, but close observation revealed that there was a detectable distortion level, or "break-up" of the signal. Switching on the BFO produced the same rough note.

This particular set included the broadcast band in its range and, without knowing quite why, I switched to this. We were both rather surprised to realise that the signals from this band were perfectly clear and, when we switched the BFO on, the resultant heterodyne was as clean as one could wish.

What was going on?

We went back to the circuit and studied it in greater detail. It took us a while to work out some aspects of it, which were rather unusual, but we finally managed it. From this a number of interesting facts emerged.

The set was a double change superhet — a fact we already knew — normally converting first to around 2200KC then to 230KC for the main IF amplification. What we had not realised, however, was that the double change feature was used only on the three highest frequency bands. On the lowest frequency short-wave band, and the broadcast band, it functioned as a single change device. Which, when you come to think of it, is a perfectly logical arrangement.

On the lower bands the first converter, a 6BE6, operated in conjunction with oscillator coils which converted the incoming signal direct to 230KC. In the plate circuit of this mixer were two IF transformers, connected in series, one tuned to 2200KC and the other to 230KC.

The output from the 2200KC transformer was connected to the control grid (pin 7) of the second converter, another 6BE6, while the output from the 230KC transformer was connected to the oscillator grid (pin 1). Also connected to this grid was the conventional oscillator coil, but so arranged that it was switched out of circuit on the two low frequency bands.

Thus, when functioning as a single conversion set, the second 6BE6 served simply as an IF amplifier, but became a converter stage converting from 2200KC to 230KC when the set was switched to the double conversion ranges

All in all, it added up to a very cunning piece of circuitry, one which must have taken quite a deal of working out in the first place. More important right now, however, was the fact that it provided a possible clue as to the source of trouble. Since it was apparent only to those bands using double conversion, it seemed logical to suppose that the second converter, when functioning as such, might be responsible.

For a start, and because it was the easiest thing to do, I replaced the 6BE6. Imagine our relief when this completely cured the trouble. A subsequent test confirmed what I now suspect; the valve had a heater cathode breakdown, and obviously large enough to inject considerable hum into the circuit.

But why was it only noticeable on those bands which involved double conversion? After all, the same valve was used on all bands, even though its function was changed.

It's not easy to be sure about this, but I suspect that the changed operating conditions of the valve provide the clue. For hum to be injected into this part of the circuit, which will not normally respond to audio frequency signals, it is necessary for the hum to "modulate" any IF signals present. In fact, without an IF signal to act as a carrier, there is no chance of the hum reaching the detector.

This form of hum, commonly called "modulation hum" is sometimes encountered in conventional broadcast receivers, usually when the converter develops some form of internal leakage similar to this one, or when the decoupling capacitor on the HT line to the converter drys out. The classic symptom is hum which appears only when a carrier is present.

But note that conditions must be favourable for the hum to "modulate" the IF signal. Modulation is normally possible only with the aid of a non-linear device, such as a converter stage deliberately operated in a non-linear mode to facilitate mixing (another form of modulation) the RF and local oscillator frequencies to produce the IF.

However, when the set was functioning in the single conversion mode the second 6BE6 would be functioning as a straight amplifier and in an essentially linear manner. Thus the hum would have far less chance to modulate the signal.

Again, one may ask why the trouble was more apparent on SSB than on conventional signals.

In attempting to answer this, it is first necessary to clarify an important point. Although we had originally suspected hum as the cause of the trouble, and had since proved this to be so, the hum, as such, had never been directly apparent in either mode.

This was almost certainly due to a deliberately restricted bass response, which is normally part of the design of communications receivers, and the natural limitations of a small speaker and minimum baffling. Thus there can be quite a high hum level present without it being directly audible. Only when an audio signal is also present does one become aware of "something" which tends to break it up. It was this "break-up" which we had observed on normal AM signals.

(Continued on page 142)

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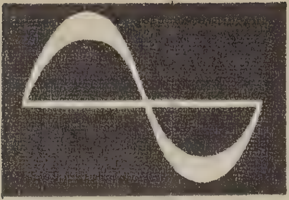

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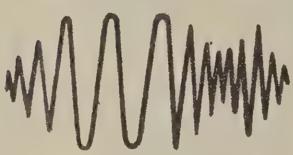

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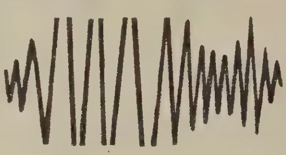

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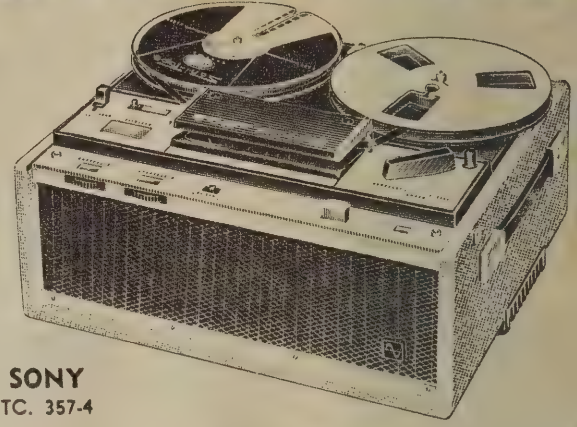

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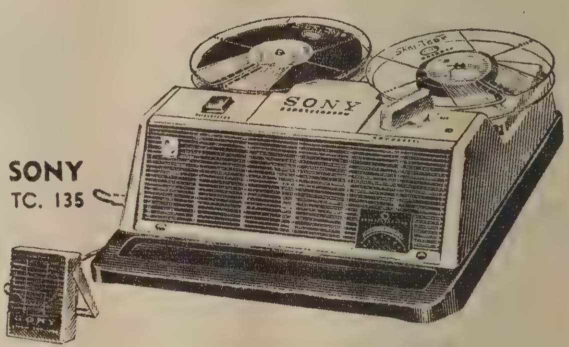

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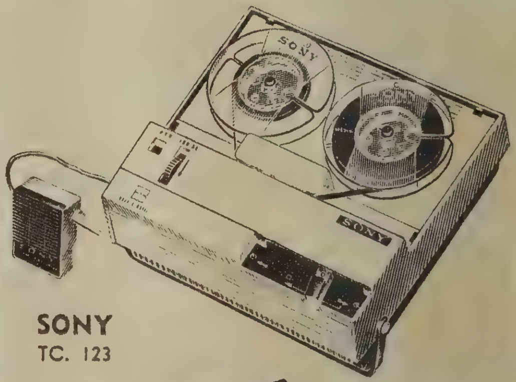

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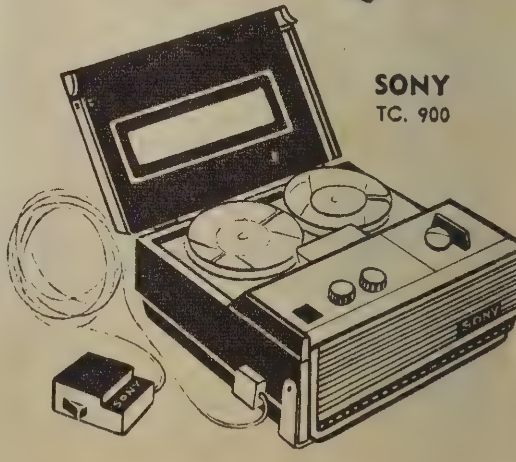

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CONVERTING LOW-BAND A-M MOBILES FOR 52-54MC AMATEUR NETWORKS

In the two-way radio industry conversion of systems from the old 60KC channel spacing to 30KC channel spacing has resulted in a large quantity of used transceivers being released on the surplus market. Of these units, a high percentage are AM transceivers covering a frequency range of approximately 70 to 85 MC. In the following article we discuss the conversion of these particular units for amateur 52MC net frequency operation.

by Keith Woodward

MOST of the units are in reasonable working order, requiring only a few minor repairs to put them in first class condition. As we cannot devote space to a lengthy article on how to repair these units, we have to assume a certain amount of technical know-how by those interested in using the equipment on the amateur bands.

The typical unit discussed in our conversion has a double conversion superhet receiver with a second intermediate frequency of 2.9MC. The first intermediate frequency varies according to the operating frequency. In the receiver designed for 70 — 85MC operation, the fundamental frequency of the receiver crystal is used to convert the first intermediate frequency to the second intermediate frequency (2.9MC). The eighth harmonic of the same crystal is used to convert the signal operating frequency to the first intermediate frequency.

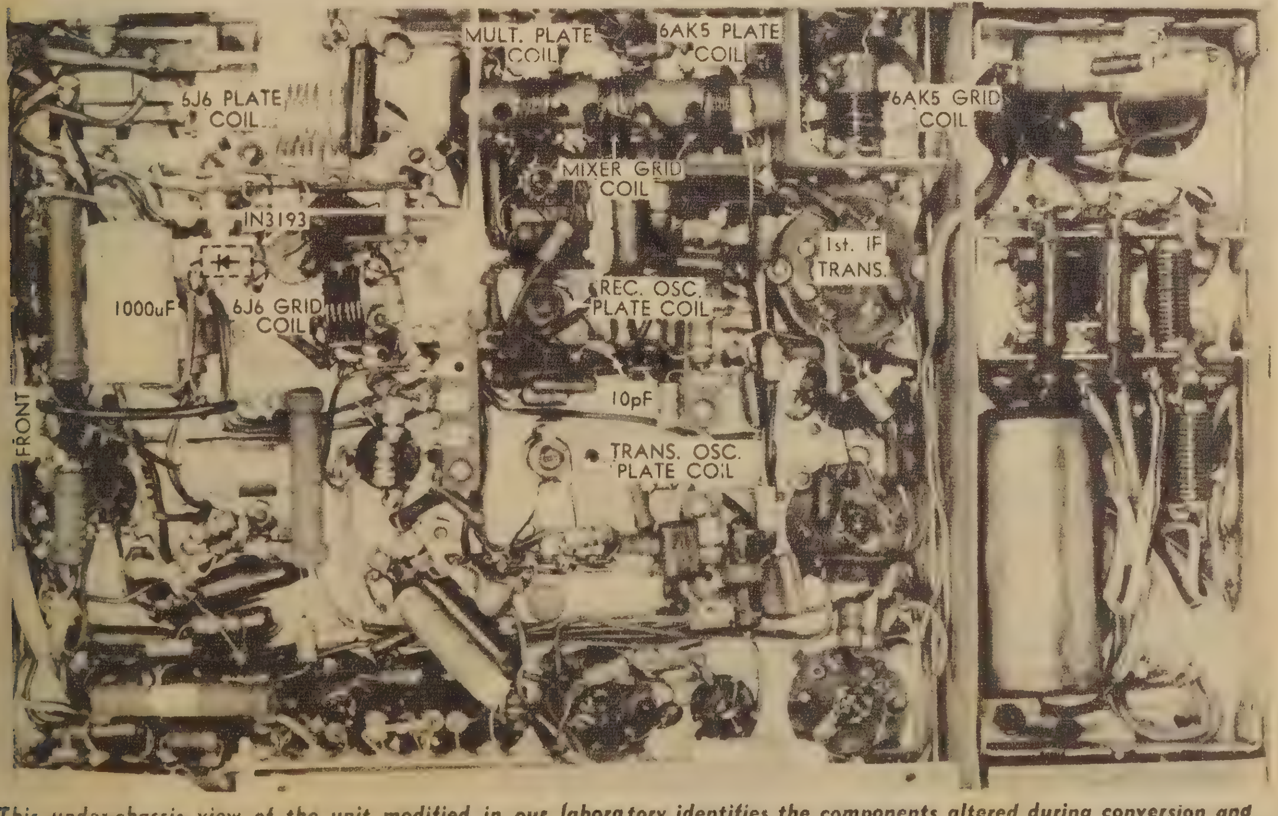
In converting for operation on the 52MC amateur band, we still utilise the fundamental frequency of a suitable crystal for IF conversion but use the sixth harmonic of the crystal for the conversion of the operating frequency to the first intermediate frequency. By way of example, if an operating frequency of 53MC is chosen, the receiver crystal would need to be 11.18MC. The first IF would be 11.18 plus 2.9 equals 14.08MC. The sixth harmonic of the crystal is 67.08MC and the difference between this and the first IF is 53MC — the required signal frequency.

While there are two versions of the transceiver converted, the one which is most likely to be encountered has the following basic line-up: The receiver RF stage utilises a 6AK5 valve, the aerial input coil being tapped for coaxial feed. The plate of the 6AK5 has its coil mounted on a bakelised cardboard tube. Alongside this coil is another which is part of the first mixer grid circuit. A third coil is mounted on this tube and is the plate coil of the multiplier stage.

The first mixer is a 6AU6 and feeds into a double-tuned IF transformer. The next stage is a second mixer, a 6BA6, which converts the first intermediate frequency to 2.9MC. The fundamental frequency of the receiver crystal used for this conversion is picked off the grid circuit of the 6AU6 crystal oscillator, the crystal oscillator plate circuit being capacitance coupled to a 6AU6 multiplier the plate coil which we have already mentioned.

The plate circuit of the second mixer feeds into two intermediate frequency transformers wired back-to-back for increased selectivity. Another 6BA6 serves as the first IF amplifier. The final IF amplifier, a 6AU6, is followed by a 6AV6 functioning as a diode detector, AVC detector and first audio amplifier.

A series noise limiter, using two Westectors, is incorporated in the detector



This under-chassis view of the unit modified in our laboratory identifies the components altered during conversion and the parts added for AC/DC operation. During earlier service one of the 22-ohm resistors on the front tag strip had been replaced by a 5-watt unit which is noticeably displaced from normal.

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circuit to give automatic noise limiting. At the intermediate frequency used in this receiver, the noise limiting appears to be quite effective. The final valve in the receiver is a 6AQ5 audio output stage, which also doubles as a modulator for the transmitter.

The transmitter consists of a 6AU6 crystal-controlled oscillator-tripler, a 6AQ5 doubler and 6J6 power amplifier. As this is the easiest section to convert, we will outline the details of the changes to the transmitter first. If the slug tuned coil in the plate circuit of the crystal oscillator is rewound with 14½ close-spaced turns of 22 SWG enamel wire, it can be tuned between 26 and 27 megacycles.

The next step is to remove the coil in the plate circuit of the 6AQ5, noting the connections. A new coil is wound with 7 turns of enamelled wire, about the same gauge as the coil removed, and small enough diameter to just pass through the centre of the centre-tapped coil in the grid of the 6J6. Pass this coil inside the grid coil and connect the ends to the same points as the coil removed. This coil should resonate between 52 and 54MC with the trimmer already in the circuit.

The plates of the 6J6 are wired to opposing neutralising trimmers in heavy tinned copper wire. The plate coil is soldered to these wires and then passes above the chassis to the tuning capacitor. With a pair of cutting pliers remove the existing plate coil at the point where it joins on to the neutralising trimmer wires, leaving the wires up to the tuning capacitor untouched. Next replace the aerial link with a three-turn link of approximately the same diameter and insulated in a similar manner as the original link.

Using similar gauge wire and diameter as the original, a new plate coil of 11 turns is wound. This coil is soldered to the neutralising wires, taking care to mesh the link in a central position. The coil is centre-tapped and fed via the original RFC, which is still suitable for this frequency of operation. When placed in service, the link coupling should be varied to achieve maximum output into the load.

The output from the modified unit is usually 2½ to 3 watts. This completes the modification of the transmitter and, if the coils have been checked with a GDO during the alteration, no trouble should be encountered in the final alignment with power applied. A temporary dummy load using a 6-volt pilot lamp (about 2-3 watt) will allow the transmitter to be peaked for best output.

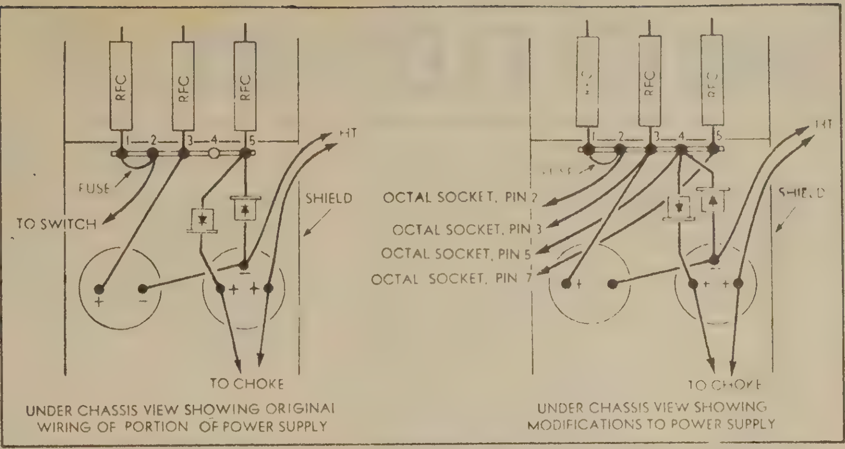
Check that the power amplifier is correctly neutralised before using the unit on the air. A quick check may be made with the dummy load by momentarily removing the transmitter crystal and ascertaining that no output is present.

CORRECT PROCEDURE

The correct procedure to neutralise the final is to remove the small link from the end of the RF choke in the plate circuit of the 6J6. Now connect a low current meter between the bottom of the 680-ohm 6J6 grid resistor and chassis. With power applied rotate the 6J6 plate tuning capacitor and note whether the meter reading dips as the plate circuit is tuned through resonance. If this occurs, the stage is not correctly neutralised.

The two neutralising capacitors should in this case be set to minimum capacitance. Now increase the capacitance of these two trimmers together step by step, retuning the plate capacitor each time, until a point is reached where rotation of the plate tuning capacitor has no effect on the meter reading. This adjustment is critical and must be carefully made, ensuring that the two neutralising capacitors are kept in step so that their capacitances are approximately equal.

The modification to the receiver requires more work but is still within the scope of the active amateur. The



UNDER CHASSIS VIEW SHOWING ORIGINAL WIRING OF PORTION OF POWER SUPPLY

UNDER CHASSIS VIEW SHOWING MODIFICATIONS TO POWER SUPPLY

The necessary wiring modifications of the power supply to achieve AC/DC operation are clearly illustrated above. The back bias components are omitted for clarity.

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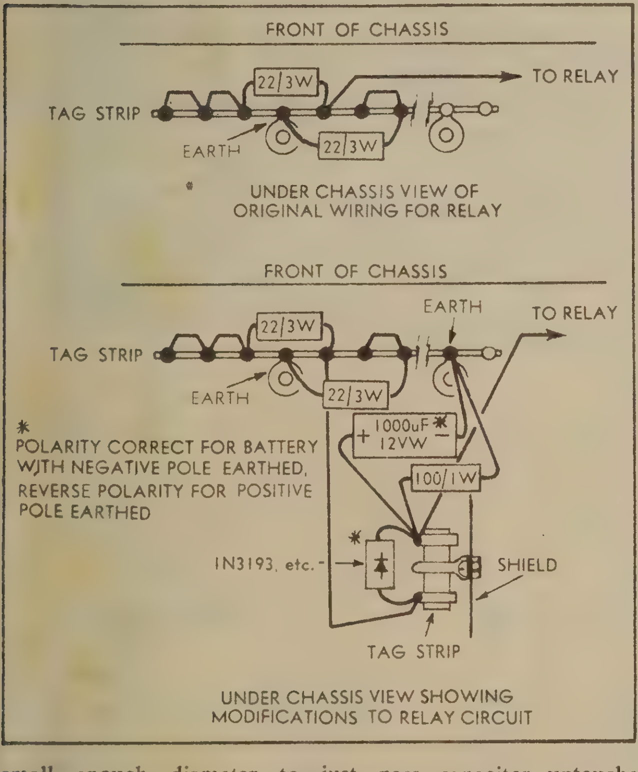
The receiver crystal for any operating frequency between 52 and 54MC can be determined from the formula: receiver crystal frequency equals Operating Frequency plus 2.9MC the total being divided by 5, all quotients being in megacycles.



UNDER CHASSIS VIEW OF ORIGINAL WIRING FOR RELAY

UNDER CHASSIS VIEW SHOWING MODIFICATIONS TO RELAY CIRCUIT

It is necessary to supply smoothed DC for relay operation when using an AC power supply and the configuration of this circuit before and after is shown on the left.

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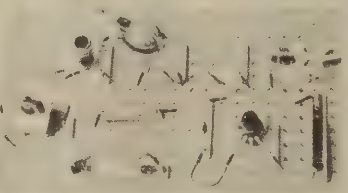

MODEL 1002.

1. Germanium Diode Radio. 2. Germanium Diode Radio. 3. 1 Transistor Radio. 4. Germanium Diode 1 Transistor Radio. 5. Germanium Diode 1 Transistor Radio. 6. Grounded base Detector 1 Transistor Radio. 7. Grounded Collector Amplifier. 8. Grounded Emitter Amplifier. 9. Resistance Coupled 2 Transistor Radio. 10. Germanium Detected 2 Transistor Radio. 11. Transformer coupled 2 Transistor Radio. 12. Short Wave Radio. 13. Radio Frequency Oscillator. 14. Morse Code Practising Set. 15. 2 Transistor Audio Frequency Oscillator. 16. A2 Telegraph Transmitter. 17. Wireless Microphone. 18. 2 Transistor Intercom. 19. 2 Transistor Audio Frequency Amplifier. 20. Signal Tracer.

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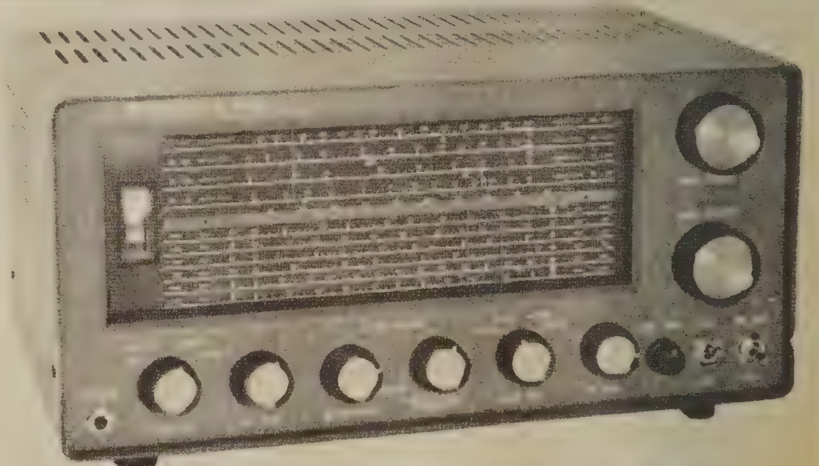

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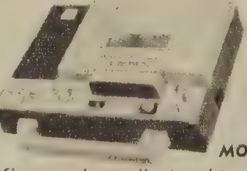

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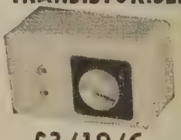

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first step is to rewind the aerial coil which may be removed by unsoldering the connections and unscrewing the screw which passes through the supporting bracket. When removed, count the number of turns and rewind it with a new coil adding two extra turns and tapping it 1½ turns from the cold end. Replace the coil and check with a GDO for resonance in the 52-54MC region.

The next step is to rewind the three coils on the bakelised cardboard former. While this can be done with the former in place it is much easier to remove it and clean the old varnish off at the same time. Before removing these coils carefully note all the connections on a piece of paper to facilitate the re-wiring. After unsoldering all the connections to the coil the bracket at the end, which is also a shield for the 6J6, will be found to be held in place by two screws.

By removing these screws and springing the bracket away from the coil former it will be found that the coil may be removed quite easily. Now rewind each coil, one at a time, cleaning away the old varnish so that a neat and efficient coil may be formed. When all three coils have been rewound they should be doped and allowed to dry before remounting the former in the set. All these coils must be rewound with approximately the same gauge wire as original and increasing the number of turns by two in every case.

Be careful not to reverse the former when replacing it in the set. All the connections should now be resoldered the only connection being altered is the 47pF capacitor to the first mixer grid. This originally was tapped well down the mixer coil but is now connected to the centre of the coil. At this stage the coils may be pre-aligned to frequency with a GDO the necessary frequencies for several of the State networks being given in the enclosed table.

OSC. PLATE COIL

The final alteration to the receiver is to parallel the oscillator plate coil with a 10pF capacitor which should allow it to tune the required frequency. At this stage it will be necessary to obtain a reasonably good signal generator. Assuming that the second IF stages, audio, etc., were functioning previously, there is no need to touch this section. Indeed as the accuracy of the receiver depends in part on the setting of the 2.9MC IF this should be left alone unless a good frequency standard is available.

Connect the output of the signal generator to the grid of the first mixer valve and set it to the first IF given in the table and peak the two trimmers of the first IF transformer. Connect the generator to the aerial connector, tuned to the operating frequency and peak the RF, aerial, mixer, oscillator plate and multiplier plate coils for maximum output. The sensitivity of the receiver should be better than 2uV for 50mW output.

If the receiver is slightly off the operating frequency this may be adjusted in two ways. The first is the use of a small amount of capacitance across the receiver crystal (if the frequency is slightly high) or a small adjustment in the frequency of the 2.9MC IF transformers. If only one channel is being used with the receiver and a crystal slightly different from that required is available, it is possible to pull the 2.9MC IF to compensate for the crystal error. A good frequency reference is desirable if this step is undertaken.

The same applies to the transmitter frequency in that, if the frequency is found to be on the high side, a small capacitor or a trimmer may be used to lower the crystal frequency. If too much capacitance is used on either crystal, the output of the oscillator will drop and it will finally refuse to oscillate.

For servicing purposes for an output of 50mW the input to the grid of the second mixer should be approximately 120uV and the input to the first mixer grid should be 12uV or less. While the receiver can be made to tune over a small range we feel that, for net operation, especially under mobile conditions, this is inadvisable. Apart from anything else it avoids the necessity of taking the eyes off the road, while driving, to make adjustments to the receiver.

The versatility of these units does not end with mobile operation. It is a simple matter to change the units over so that they may be operated on either battery or AC supplies. All that is required, other than hookup wire, for the conversion is two octal plugs and a power transformer with two 6.3V secondaries (or one 12.6V winding) and a secondary winding supplying approximately 125VAC at 100mA.

METERING SOCKET

On one side of the transceiver an octal socket is located which was originally used for metering purposes. Remove the wiring from pins 2, 4, 5 and 7. The wire from the on/off switch to the fuse in the power supply, on tag 2, should be cut near this octal socket so that the wire from the switch may be soldered to pin 4 and the wire to the fuse can be soldered to pin 2. The next step is to run a wire from pin 7 of the octal socket to tak three in the power supply.

The junction of the two power diodes normally connected to tag 5 in the power supply should now be shifted to tag 4, a vacant tag. From tag 4 a wire is run to pin 5 of the octal socket. This is all the re-wiring involving the high tension and heater supplies that is required in the unit. As the unit now stands the low tension and high tension supplies of the power supply have been open circuited.

To restore battery operation it is only necessary to plug in an octal plug with a strap between pins 2 and 4 and another strap between pins 5 and 7.

The second octal plug is wired to the power transformer with the 125-volt secondary connected to pins 3 and 5, the active end of the 12.6 volts to pin 4 and the earth end of the 12.6 volts to pin 6. For AC operation this plug should be inserted in the octal socket in place of the previous plug.

This system uses the voltage doubler circuit already in the transceiver to obtain the high tension voltage and bias supply and feeds the filament voltages while isolating the vibrator section. When operating on the AC supply leave the on/off switch on the front panel in the off position so that there is no danger of the 12.6 volt AC line being accidentally shorted to ground.

The final modification involves the change-over relay which must be supplied with filtered DC for smooth operation. This is achieved by using a 1N3193 diode, or an equivalent, in series with the lead to the relay as shown in the accompanying drawings. The filter is a 1000uF 12 volt electrolytic capacitor. As shown the wiring is for a negative earthed battery supply. For those interested in positive earthed battery supplies it is only necessary to reverse the connections of the diode and the filter capacitor.

If the incorrect polarity of diode is used the relay will work on AC but not on DC. The 100 ohm resistor in this circuit is to limit peak voltages applied to the filter capacitor when the relay is not operated. Using all the diagrams this brief explanation should be sufficient to allow the average amateur to convert these transceivers for AC/DC operation.

VERTICAL POLARISATION

For net frequency operation most mobiles will be operating with vertically polarised antennas and the use of vertical polarisation from home stations will usually give best results. Some suitable aerials for this application were discussed in our July 1964, edition, copies of which are available through the query service.

Glossy prints of the front panel shown on our prototype are available through the query service for 5/ each. In our case we found that this adhered quite well to the original panel by using Tarzan's Grip.

Earlier in the text we mentioned that there is another version of the transceiver described. This version is an earlier production of this transceiver using English components. Instead of the 6AK5 and 6AU6 valves it uses EF91's and the 6BA6 positions utilise EF92 valves. In place of the audio 6AQ5 may be found an EL42 and the 6AQ5 in the transmitter position is usually replaced by an EL91. The other valves used are the same as the all-Australian version. Sometimes these units may be found semi-modified for the valves mentioned in the Australian version. The modifications, as listed, apply also for these units.

While our conversion details have been confined to one make of transceiver there are several other makes of low-band AM transceiver which use similar circuits and are suitable for modification to the 52MC band. It is usually necessary to determine the second intermediate frequency in the receiver so that the correct receiver crystal and multiplication can be chosen. ■

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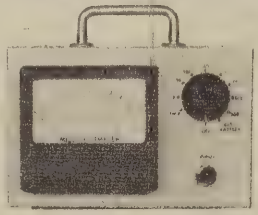
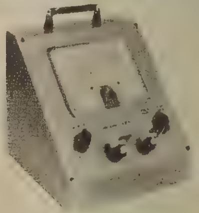
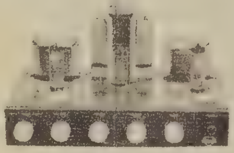


Transistor m/v Meter

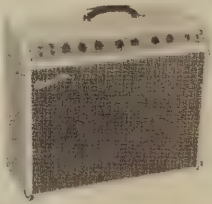
1964 TV Receiver



Impedance Meter



Mullard Stereo 3-3



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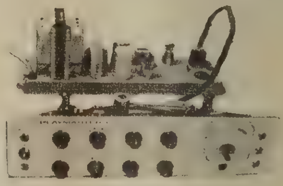

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27 Transistor 2W
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78 1962 Wide Range Audio Oscillator
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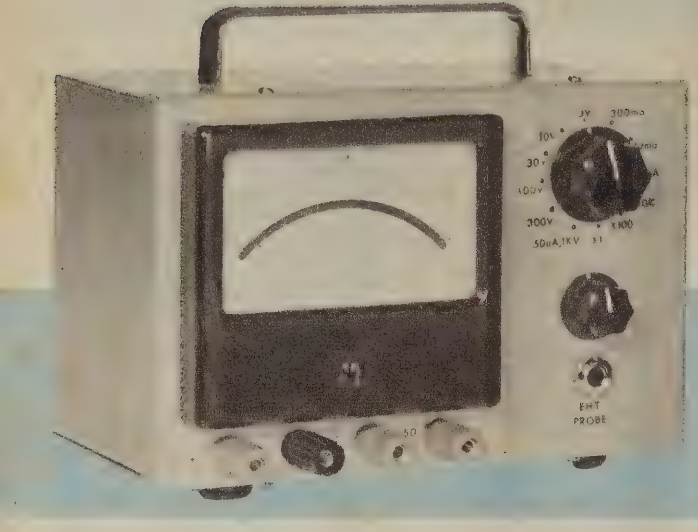


A Protected 20,000 ohm/volt DC Multimeter

By Keith Woodward

Following last year's article describing a Fully Protected 20,000 Ohms/-Volt Multimeter we received several requests for a multimeter circuit both smaller in physical size and lower in cost. To meet these requests we have developed the multimeter now featured, which we believe will meet the majority of service technicians' requirements.

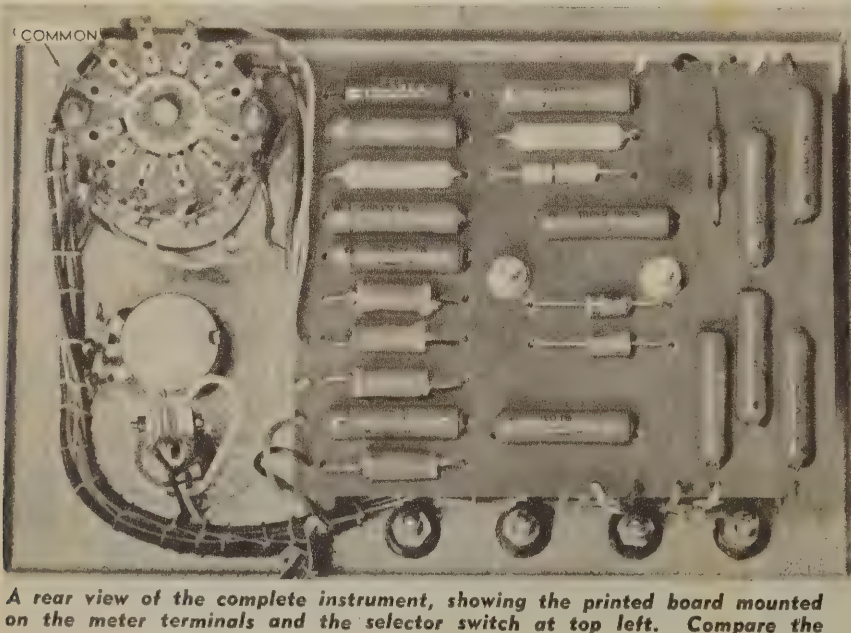
THOSE who commented on the 1964 design emphasised that they liked many features of it, including the 20,000 ohms/volt sensitivity, the protection facilities, and the relative ease with which repairs could be made using readily available local components.

On the other hand, there are many who felt that it was too complex and too expensive for their particular needs. While it was fine for a well equipped workshop or laboratory, it was not the kind of thing which a service technician could conveniently carry with him for use in the field. What was clearly wanted was a scaled down version, retaining the most desirable features, but dispensing with those which are needed rarely, if at all, in this kind of work. This version is the result.

Naturally, the new design had to be a compromise. Lengthy discussions took place as to which facilities gave the best coverage and which might be neglected, without detriment to the performance, before it was finalised.

One feature which we were not prepared to discard was overload protection. This is achieved by using a pair of silicon diodes across the meter movement. The forward charactersitic of the diodes is such that, for currents corresponding to normal deflection, they have negligible effect on meter operation; for currents which would normally damage the meter they provide quite heavy protective shunting.

With the constants involved an overload of approximately 10 times the full scale deflection is all that will ever be allowed to reach the meter and most meters are capable of handling this order of overload without damage. A full discussion of overload protection is given in articles published in December, 1959, and January, 1960.



A rear view of the complete instrument, showing the printed board mounted on the meter terminals and the selector switch at top left. Compare the board layout with that shown on page 77.

As an initial step in scaling down it was decided that limited need for AC ranges warranted dropping this facility. This decision reduced the switching complexity considerably, and this alone provided a worthwhile saving. Other components discarded by the omission of the AC ranges saved an additional £2 to £3.

This left our project as a high sensitivity DC multimeter. Pursuing the theme of limiting costs we decided it was mandatory to use a selector switch which was a standard production item, available over the counter at the local warehouse. The switch finally selected was a three wafer, single pole, 12 position type.

This naturally limited the multimeter to 12 switched ranges. Actually the final design provides 13 ranges by means of additional terminals, plus a plug-in facility for external probes. The 13 ranges include a high voltage range (1KV), or a low current range (50uA), selected by two separate terminals on the front panel and the first position of the switch. All the other ranges use common terminals.

As the majority of measurements made with a multimeter involve voltages, we elected to use 6 of the ranges for voltage scales. Positions 2 to 6 of the switch select ranges with full scale deflections of 300V, 100V, 30V, 10V and 3V. It will be noticed that we have used an approximate 3:1 ratio between ranges, allowing more accurate readings than the more usual 5:1 range provided by many multimeters.

This left six ranges to provide current and resistance measurements. Positions 7, 8 and 9 were used for current ranges of 300mA, 30mA and 3mA respectively. Three resistance ranges on positions 10, 11, and 12 are ohms x 1, ohms x 100 and ohms x 10,000. The first major division on the lowest ohms range is 1 ohm and the last major division on the highest range is 10 megohms. In general measurements around our own workshop we found these ranges covered our needs quite adequately.

An insulated jack on the front panel allows external probes, such as an EHT probe, to be patched directly into the protected micro-ammeter circuit. This is an optional extra and is of most use to technicians engaged in TV service or in servicing oscilloscopes. This jack could be used for other types of probes and may even provide facilities for an external AC adaptor.

The ranges thus provided by the instrument will allow the measurement of all common voltages and currents likely to be encountered in electronic servicing. With the facility for measuring quite high value resistors added to this we feel that the multimeter will handle all contingencies encountered in field work and also become a very handy test instrument on the service bench. The small instrument case used for the multimeter results in a highly portable meter without making it so small that wiring becomes difficult. A handle may be selected from the local hardware store. In passing, one of our readers suggested that a meter of this type might be built into the corner of a tool case, and the size of our multimeter would certainly lend itself to this application.

PARTS LIST

- **1 Standard Instrument Case, 7½ x 5 x 4 inches.**
- **1 50uA, 2000 ohms 4 inch rectangular meter.**
- **1 3 wafer switch, each wafer single pole 12 position.**
- **1 15 volt battery, Eveready 411 or similar.**
- **1 1.5 volt cell, Eveready X-71 or similar.**
- **2 Silicon diodes, 500mA 50PIV, 1N3193 or similar.**
- **1 Closed circuit type telephone jack.**
- **4 High grade terminals, 3 red, 1 black.**
- **1 Carrying handle.**
- **1 Printed wiring board, 65/M9.**
- **1 Small knob.**
- **1 Large knob.**

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- **1 100 ohms.**
- **1 680 ohms.**
- **1 1K**
- **1 15K**
- **1 60K**
- **1 150K**
- **1 200K**
- **1 620K**
- **2 2 meg.**
- **1 4.3 meg.**
- **2 10.0 meg.**

1 Per Cent Meter Shunts

- **1 .333 ohms**
- **1 3.33 ohms**
- **1 14.7 ohms**
- **1 33.7 ohms**

5 Per Cent Resistors

- **1 1K**
- **1 1.8K**
- **1 10K**
- **1 180K**
- **1 1500 ohms wire wound pot.**

Miscellaneous

Rubber feet, leads, screws, nuts, solder, hook-up wire, tinned copper wire, etc.

Naturally a strong metal shield would be required between the meter and the tool section.

We elected to use the same meter movement and scale as in the full-sized 1964 model. Thus we have a stepped scale on the multiples of 3 and 10 to correspond with the dB scale on the dial. While the dB scale is of little immediate use owing to the lack of AC ranges, it could prove handy if used with an external AC probe or adaptor.

The meter shown in our photograph has a mirror scale and was made by University Graham Instruments. However, due allowance has been made on the printed wiring board for all standard meters, in that one of the mounting holes is slotted to compensate for the various spacings of meter terminals.

The high stability resistors used in the instrument call for some comment. Until recently, there have been good

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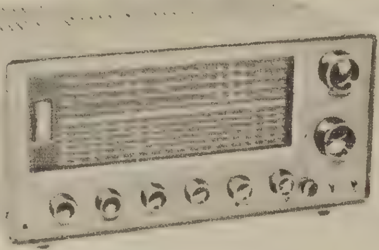

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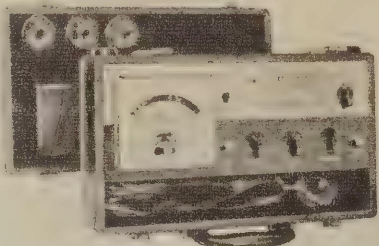

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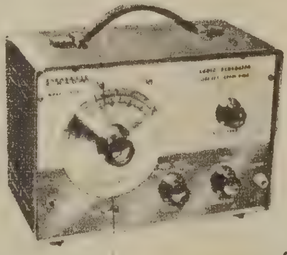

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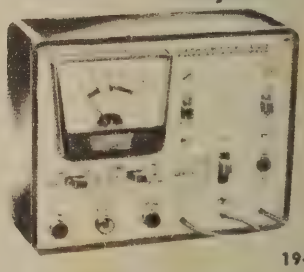

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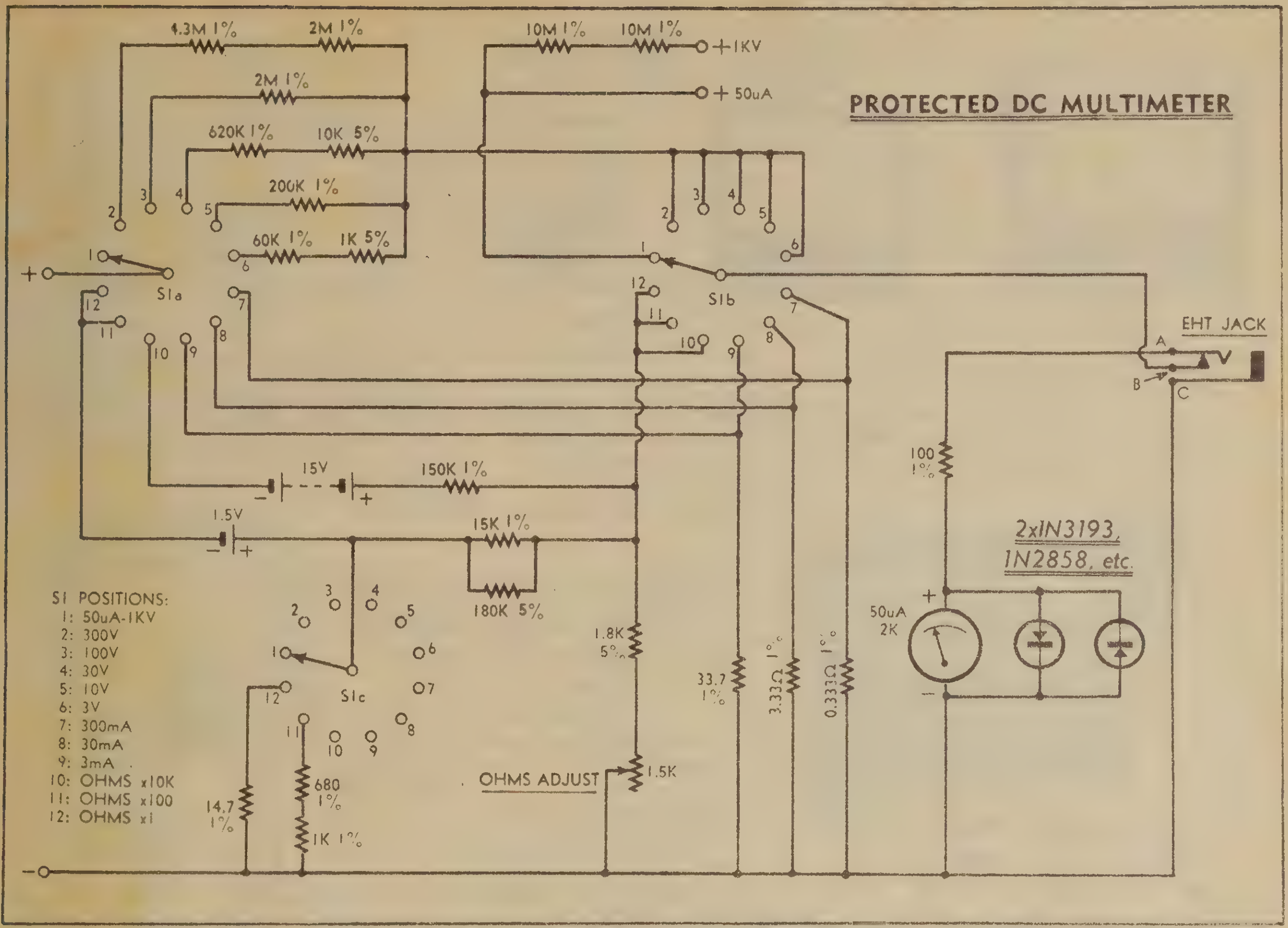
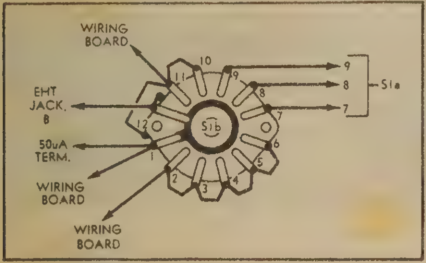


The circuit diagram shows all the wiring, even though much of it will be provided by the printed wiring board. The numbered switch positions will assist in wiring the switch.



This switch wafer diagram is intended to help relate the circuit switch contact numbers with their physical position on the wafer.

supplies of these from overseas, readily available across the counter in the ones and twos needed by the home constructor. Unfortunately, this source now appears to be drying up.

There are also local sources of these resistors, but there appear to be some distribution problems which often make it difficult for the individual to purchase them in small quantities, However, this position may improve.

In the meantime, at least two advertisers are planning to release kits of resistors and shunts and this should solve a lot of problems.

Another feature we retained from the 1964 model was a printed wiring board. This allows the multipliers and shunts to be securely mounted and at the same time simplifies construction. It also gives a professional appearance to the instrument and helps maintain its value. Incidentally, all the components used are the same as those used in the earlier version, and they could be used at a later date to construct the 1964 multimeter should this be desired.

The batteries used in our prototype were a type X-71 1.5V cell for the low resistance ranges and a type 411 15V battery for the high resistance range. These batteries, placed one on top of the other, fit in a simple metal clamp on the back of the instrument case.

The terminals on the front panel are of the type which will accept either banana plugs or spade terminals. We found when mounting our terminals that the thickness of the front panel metal was insufficient to allow the terminals to be completely tightened. An insulated washer drilled to clear the plastic barrel of the terminal was used at the rear of the panel and provided a tight fit. Incidentally, this terminal has a small plastic stud which fits an indentation in the terminal hole and stops it from rotating.

The jack used for the external probes is a normally closed circuit type. When the probe plug is inserted the external circuit is connected to the protected micro-ammeter and the internal circuits are automatically disconnected. Note that this jack must be insulated from

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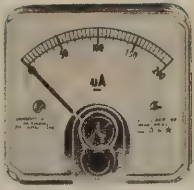
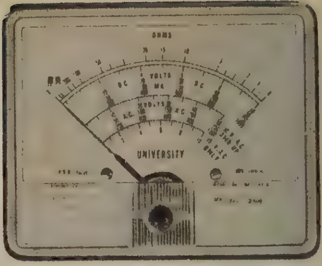


Model W2.



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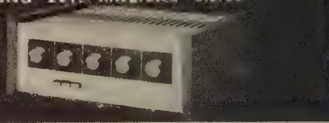

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the front panel of the instrument for safety reasons. Usually these jacks are sold with one insulating washer only and it is necessary to procure a second and, if possible, a small insulating ring to space the jack from the metal panel. In our prototype we manufactured these from a small strip of bakelite.

In our July, 1964, edition we described the construction of an EHT probe which is suitable for use with this project. Unless there is a definite requirement for this probe we do not suggest a blind order for the components, as they are rather expensive.

The ohms range zero potentiometer should be of the small variety measuring approximately 7/8in across the back of the enclosing can. This leaves plenty of room for mounting the components and simplifies the wiring.

To help identify the switch contacts, our circuit diagram labels each switch section and terminal clearly. The switch section labelled Slc is the wafer closest to the front panel, the middle wafer is identified as Slb and the remaining wafer as Sla. We have provided a drawing showing the back of the printed wiring board, and with each lead from it identified as to the final destination.

Before mounting the switch, several of the switch terminals which are strapped together can be pre-wired. To help identify the switch terminals a sketch of the wafer Slb is included among the illustrations. Care must be exercised in wiring a 12 position switch owing to the unusual configuration associated with the 12th contact.

In pre-wiring the switch, terminals 2, 3, 4, 5 and 6 of Slb should be wired together, also terminals 10, 11 and 12. Note that terminal 12 is located under terminal 1. Join terminal 7 of Slb to 7 of Sla, 8 of Slb to 8 of Sla and 9 Slb to 9 of Sla. The final pre-wiring is to join terminals 11 and 12 (under 1) on Sla. The completed switch may now be mounted.

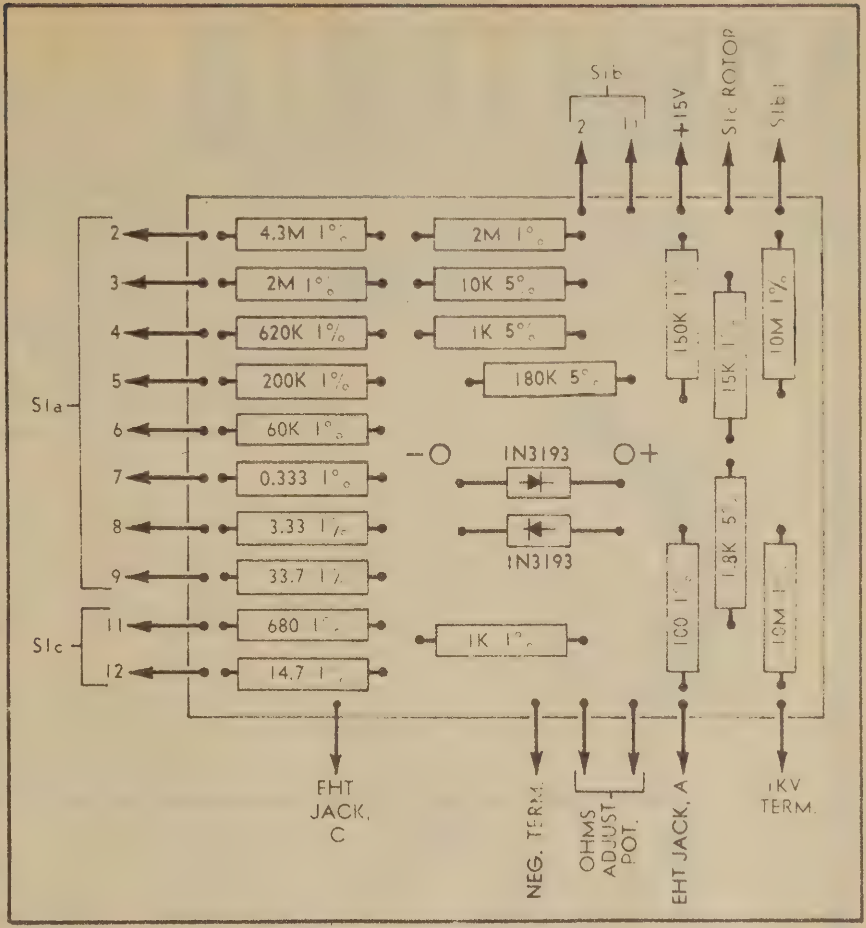
In all switch wafers having 12 positions, 2 contact are used for the common terminal, one above and one below the wafer. These should be joined together when the leads to these terminals are soldered in place. The rest of the wiring is straightforward and no trouble should be encountered.

When all components have been mounted on the printed wiring board the leads may be attached and cut to approximate lengths, none of which need be longer than 22 inches and most considerably less. The board may then be mounted on the meter terminals, making sure that good contact is made with the copper pattern. The wiring may now proceed and we suggest that the switch sections be wired in order of Slc, Slb and Sla.

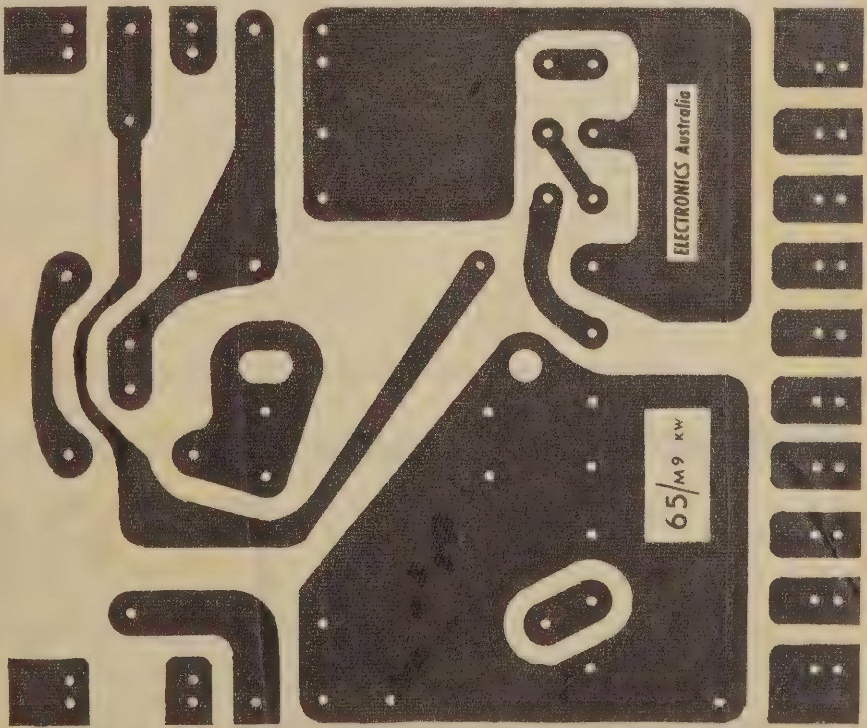
When soldering components on the printed wiring board care should be exercised not to overheat the board and lift the copper. Overheating the precision resistors should also be avoided.

When the wiring is completed and the meter tested, the wiring may be laced with light twine or dial cord. This not only gives a neat appearance to the finished meter but lessens the possibility of a fractured wire through movement of the leads.

The use of separate terminals for the 1KV and 50uA ranges reduces the chance of errors when selecting these ranges. Neither of these terminals will become active unless the switch is in the correct position.



Above: A detailed layout diagram of the rear of the printed wiring board. It is only necessary to follow this arrangement to correctly assemble the components on the board. Below: The printed board. Hold it this way up, turn it over left to right, and it is correctly positioned to assemble as above.



Shortly after this article appears metalwork for the project should be available through our advertisers or, for those who like to do their own metalwork, a blueprint is available from our query service for the normal fee of 5/-. While our lettering on the prototype was done with a dry transfer process it is usual for advertisers to release the metalwork with an etched panel.

The printed wiring board should also be released shortly and will be overprinted with identification of the components used. This will allow the components to be mounted without reference to the circuit diagram.

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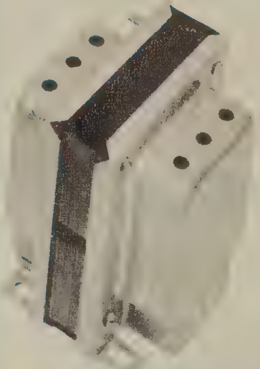

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*● **PF1460**	230, 240, 250	250/250V.—80mA.	6.3V.—2A.C.T., 6.3V.—2A., 6.3V., TAP 5V.—2A.
* **PF170**	230, 240	285/285V.—80mA.	6.3V.—2A.C.T., 6.3V.—2A., 6.3V., TAP 5V.—2A.
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* **PF130**	230, 240	285/285V.—100mA.	6.3V.—2A.C.T., 6.3V.—2A., 6.3V., TAP 5V.—2A.
* **PF160**	230, 240	385/385V.—100mA.	6.3V.—2.5A.C.T., 6.3V.—2A., 5V.—2A.
PF152	230, 240	285/285V.—125mA.	6.3V.—3A.C.T., 6.3V.—2A., 6.3V., TAP 5V.—2A.
PF163	230, 240	325/325V.—125mA.	6.3V.—2.5A.C.T., 6.3V.—2A., 6.3V., TAP 5V.—2A.
PF174	230, 240	285/285V.—150mA.	6.3V.—3A.C.T., 6.3V.—3A., 6.3V., TAP 5V.—3A.
PF142	230, 240	325/325V.—150mA.	6.3V.—2A.C.T., 6.3V.—2A., 6.3V., TAP 5V.—3A.
PF175	230, 240	385/385V.—150mA.	6.3V.—2A.C.T., 6.3V.—2A., 5V.—3A.
PF1067	230, 240	400/400V.—180mA.	6.3V.—2.5A.C.T., 6.3V.—4A.C.T., 5V.—3A.
PF1412	230, 240	300/300V.—200mA.	6.3V.—3.5A.C.T., 6.3V.—3A., 5V.—3A.
PF140	200, 230, 240	385/385V.—200mA.	6.3V.—3A.C.T., 6.3V.—3A., 5V.—3A.
PF172	200, 230, 240	500/500V.—200mA.	6.3V.—4A.C.T., 6.3V.—3A., 5V.—3A.
PF814	200, 230, 240, 260	1000/1000V.—200mA. or 750/750V.—250mA. or 500/500V.—300mA.	5.8V.—0.3A
PF171	200, 230, 240	385/385V.—250mA.	6.3V.—4A.C.T., 6.3V.—3A., 5V.—3A.
PF107	230, 240	585/585V.—250mA.	6.3V.—3A., 6.3V.—3A., 5V.—3A.
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the "Answer Man" Explains

Stereo and Mono Cartridges

The Answer Man has been called upon, this month, to deal with quite a pot pourri of subjects. The first question intrigues us somewhat, because it has been fired at us independently by a number of readers. Perhaps it has been initiated by some published statement which we ourselves have not seen.

I have only a mono replay system but want to start buying stereo rather than mono records. I planned to switch to a stereo cartridge, using it as a mono for the time being, but was told that all I need to do was to fit my present mono cartridge with a stereo stylus. Does this make sense?

The basic difference between mono and stereo records is that the grooves in the latter contain a vertical modulation component, which requires that the replay stylus be able to move vertically as well as horizontally. In other words, the stylus system must exhibit adequate vertical as well as adequate horizontal compliance.

If the stylus system lacks vertical compliance, one must expect stereo grooves to suffer some damage as the unyielding stylus is dragged across the vertical serrations. Thus, while a mono pickup will certainly play a stereo record, apparently successfully, it is anybody's guess in what state the stereo information will be after the experience.

In stereo pickup cartridges the necessary vertical compliance is designed into the stylus system. To be sure, some cartridges have more commendable characteristics than others — more compliance than others, with lower stylus mass — but at least provision is made to meet the requirement.

For this reason, we have always proferred the advice that stereo records be played **only** with stereo cartridges. With stereo amplifier systems, the two signals from the cartridge are fed to the respective amplifier channels.

When used with a mono amplifier systems, the two "active" leads of the cartridge are strapped, also the two "earthy" leads and the output treated as a normal mono signal. In these circumstances, while the stylus tracks the vertical modulation, with no more than natural wear, the cartridge produces only a composite mono signal.

Does it follow then that the advice to retain the mono cartridge was wrong? Not necessarily so.

In fact, some mono cartridges may exhibit a good deal of vertical compliance, either because it was so intended or as an "accident" of the design.

In the days of mono cartridges, for example, a good deal or argument centred around the question of vertical compliance in relation to the subject of "pinch effect." This was the term used to describe the tendency of a replay stylus to lift slightly as it negotiated certain sections of heavy waveforms where the groove walls tended to be steeper than elsewhere—a function of the original wedge-shaped cutter.

Some designers regarded vertical compliance as a desirable quality and built it in deliberately.

Again, quite a few mono pickups were produced having their stylus tip at the end of a quite long cantilever arm and this system inevitably yielded some vertical compliance.

But in all such cases, the vertical compliance was either an "accident" of design or provided to compensate for forces quite different from those involved in tracking vertical groove modulation.

The only safe general rule is the one mentioned earlier — don't play stereo records with mono cartridges.

It may be, however, that individual mono cartridges have sufficient vertical compliance to play stereo records and this could have been the basis of the advice which prompted this whole discussion. The only safe procedure would be to check with the informant and ask specifically about the vertical compliance of the particular cartridge. If he can assure you that it has been checked and found adequate, all may be well.

If he is vague about the matter, be wary.

It is true that stylus dimensions are involved. For playing mono microgroove, standard practice has been to use a stylus with a tip radius of .001 inch.

For stereo, something like half this figure is desirable but it has become common practice to use a figure of .0006 or .0007 inch as a "universal" dimension suitable for general mono and stereo playing.

Most stereo cartridges are fitted, nowadays, with styli of about this dimension.

Fitting such a stylus to a mono cartridge — assuming one is available to suit the cartridge — would overcome any problem of groove fit but would not provide the answer to inadequate vertical compliance. This is a matter for the cartridge itself and is the point you should carefully check up on.

Incidentally, on page 101 of our May issue, we mentioned a CBS test record which, among other things, could provide a guide as to whether any given mono cartridge could be used safely with stereo records.

This is an interesting facility but we could scarcely advise buying the record for this purpose alone. Its purchase price would go a long way towards the cost of a new stereo cartridge!

Has any progress been made in the design of picture display devices likely to displace the picture tube in a TV receiver.

It would probably be wrong to suggest that no progress has been made in these devices, because they could well become practicable as the result of various contributing technologies. To the best of our knowledge, however, anything to replace the picture tube is still very much in the laboratory stage and the future of the picture tube, as we know it, seems assured for a good while yet.

Recently I saw a brochure from an overseas company advertising a device for reducing feedback in public address amplifiers. Apparently it is some kind of mysterious "black box" through which the signal is fed, external to the main P.A. amplifier. How on earth would such a thing work?

When a public address amplifier is operating in a typical situation, some of the sound energy from the loudspeaker system usually finds its way back to the input microphone and is re-amplified. Technically, this can be described as a feedback loop, in which part of the loop is an acoustic path.

If the level of sound reaching the microphone from the loudspeakers is relatively small, it may not produce much audible effect. Routine precautions aimed at achieving this situation involve such things as keeping the loudspeakers well away from the microphone, using direc-

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tional loudspeakers faced away from the microphone or using a microphone which is insensitive to sound other than that arriving from a specific direction.

In many cases, however, it is difficult to maintain adequate isolation between the loudspeaker system and microphone and the most obvious sign of trouble, as the amplifier gain is advanced towards working level, is a tendency for the system to "ring" at some particular frequency, when handling signal.

If the amplifier gain is advanced beyond this "ringing" level, the whole system may break into a howl, usually at about the same frequency at which the original ringing was heard. In this condition, the feedback loop has promoted active audio oscillation.

The "Feed-Bak Stabiliser" referred to in the text.

Such oscillation or howling usually becomes evident at the frequency where the gain of the overall system is highest. The frequency response of the amplifier —therefore its tone control setting—has some bearing on this but, as a rule, the frequency of highest overall gain is where either the loudspeaker system or the microphone happens to exhibit a resonance peak. If two such peaks coincide, or the situation is aggravated by the acoustics of the room, feedback troubles can become very acute.

This being so, a second major precaution against feedback is to select microphones and loudspeakers which are as free as possible from response peaks. This means that the amplification effective over the whole audio spectrum can be that much higher before any given response peak is prominent enough to produce active audio oscillation.

However, there is a limit to what can be achieved by selecting loudspeakers and microphones and manipulating their physical positions and it is not uncommon, after accepted methods have been exhausted, for acoustic feedback to become evident before the level of amplification is really adequate for the particular situation.

How many times have your heard TV stations run into trouble with their studio amplifiers, when producing live audience shows?

The question is what to do next.

Mostly, the answer is pretty much a lemon; there isn't much else one can do ... except for this gadget which you mention.

Possibly the leaflet you saw is one which turned up at our office recently. (To save ourselves answering a sheaf of letters, it came from Audio Products Inc., 7365 Orchard Lake Road, Farmington, Michigan, U.S.A. The unit has been advertised in this journal by Hodges Sound Systems of 35 Lewis Street, Balgowlah, N.S.W.)

Called the "Feed-bak Stabiliser" this gadget appears to use the principle which was devised, to the best of our memory, by one of the big U.S. companies some years ago ... G.E. or Bell, most likely.

It employed a heterodyne principle whereby the incoming signal was heterodyned against one frequency, the heterodyne against a slightly different one, such that all frequencies passing through the device were shifted by a given small frequency. A figure of 5cps is mentioned for the "Feed-bak Stabiliser."

It is claimed that such a small shift is not noticed by listeners, even where the original sound and the reproduced sound can be heard simultaneously.

However, in terms of the feedback phenomenon, the shift is very important because it interferes with the tendency for energy in the system to gradually build up to an active howl at one or other of the response peaks.

Instead of being able to circulate through the loop, energy finds itself constantly being shifted along the spectrum.

The makers explain its operation in a somewhat different way. They point out that, over the critical middle range, where feedback problems mostly concentrate, the average amplifier/room combination shows a series of peaks and troughs separated by about 10cps.

By shifting all frequencies by about half this amount—they select 5cps—there is a tendency for energy from peaks to be shifted into an adjacent trough, and the attenuation of troughs to be reinforced by adjacent peaks. Thus, as far as the feedback loop is concerned, a net flattening effect is achieved.

It would be nice to think that the system was so efficacious that feedback was eliminated entirely but such is not the case. The technique can inhibit the build-up of acoustic energy and effectively flatten the loop gain curve but, if the main amplifier gain control is advanced too far, an oscillatory condition is re-established, irrespective of the frequency shifting technique.

The makers of the "Feed-bak Stabiliser" claim that their unit will allow a typical amplifier system to operate at a level some 6 to 12dB higher than would otherwise be the case ... and this could be vital.

Unfortunately, the technique involves a good deal more than a few extra components dropped into a basic amplifier.

The signal has to be accepted at appropriate level and impedance, possibly split into bands, heterodyned to a new set of frequencies, heterodyned back to frequencies critically close to but different from the original, probably filtered to remove unwanted by-products of the process, then reconstituted for delivery at the output terminal at appropriate level and impedance.

All this adds up to quite an array of circuitry including a couple of very critical crystals to control the heterodyne functions. It is not the kind of thing that a home builder could expect to get working easily or cheaply—if at all!

What's more, if you want to buy such a thing ready made, take deep breath as you reach for your cheque book — it will cost you plenty!

The device as illustrated on the leaflet is a self-contained unit, apparently styled for rack mounting, which is either jacked in into the main amplifier chain or used as a substitute front end.

It is an interesting technique but our impression is that it is one which would logically be resorted to only after one had exhausted other techniques mentioned earlier.

In short, it is something one would consider AFTER having put in high quality, directive microphones and loudspeakers, not before! ◘

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A SINGLE-ENDED PUSH-PULL TAPE RECORDING AMPLIFIER

Mr E. Robertson of 9 Naree Road, Frenchs Forest, NSW, is something of a perfectionist, to judge by his contribution to this page. Whether or not you are tempted to try his circuit, the thinking behind it is interesting. The article which follows is as submitted by Mr Robertson.

FOLLOWING publication of the article in respect of the "Playmaster 110 Tape Amplifier Unit" in the April and May issues of your journal, I decided to modernise my Collaro tape recorder deck by replacing the Reuter heads with Brenell Bogen.

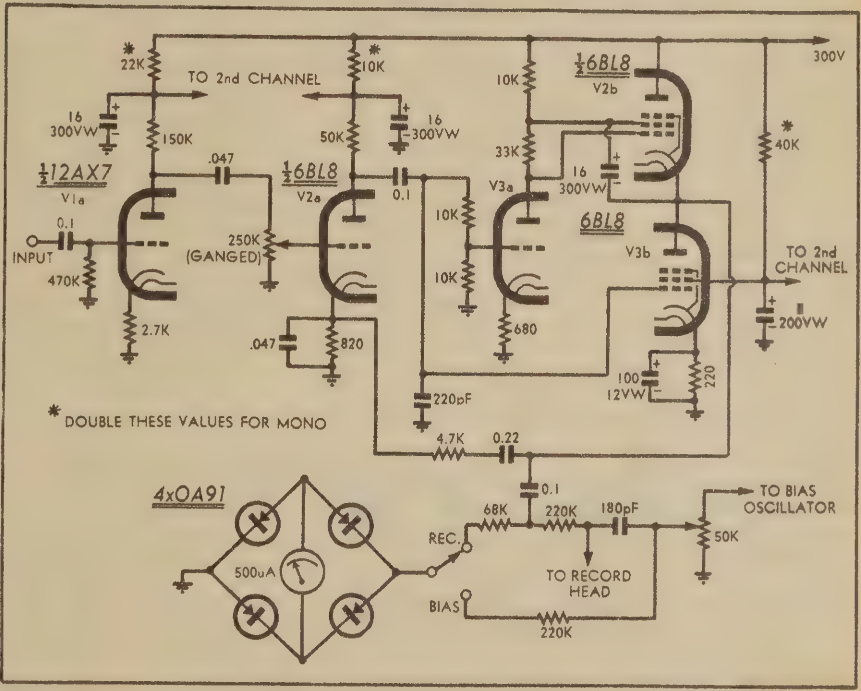
The heads I purchased included a Hi-Fi Record Play unit with an impedance of 3,500 ohms at 1KC requiring 50 micro-amps recording current. Having in mind an anticipated frequency response up to 12KC, the maximum head impedance would be in the order of 42,000 ohms. In order to obtain constant recording current within the frequency range a series resistor of the order of 10 times this figure is desirable — that is to say 470,000 ohms. To obtain the necessary recording current through this impedance a voltage of 25 volts is required.

Although this voltage is not difficult to produce with a triode or pentode amplifier, considerable even harmonic distortion can be expected to occur. Having spent in excess of £25 on the new heads I decided that something better than a simple single-ended amplifier was warranted, so I set to and designed an amplifier along the lines of the one published in the May, 1963, "Reader Built It" series of Radio, Television and Hobbies. The unit is described hereunder.

The circuit uses 2 — 6BL8 and ½ 12AX7 valves in each channel amplifier. The pentode sections of the 6BL8's are connected in cascode to form a single-ended push-pull connection. One triode section is used as a phase inverter to supply signal to the upper pentode.

This pentode requires special consideration in so far as its input signal concerned, because its cathode does not remain at earth potential but varies with the signal. In order that the signal fed to the upper pentode remains relative to its cathode, the anode supply to the phase inverter is tied to the cathode through a 16uF 300VW electrolytic capacitor. A 10Kohm resistor supplies the DC voltage with the superimposed signal to the phase inverter and the screen of the upper pentode.

The triode section of the other 6BL8 serves as an amplifier and to provide frequency compensation to suit the head and tape characteristics.



Cathode bypass capacitors are generally avoided so as to retain good waveform. This feature, coupled with the high degree of feedback in the output stage provides 30 volts RMS output signal at very low distortion. Beyond 30 volts, crossover distortion occurs but distortion is only slight at 40 volts output.

The amplifier is extravagant with valves, but this is usual where push-pull circuits are involved.

Bias is supplied at 60KC to the recording head through a 180 pf capacitor. The voltage is adjusted with a 50,000 ohm potentiometer. Best results using "Triton" tape were found to be at 44 volts, although the manufacturers recommend 60 volts.

Using a "flat" preamplifier (EF86) and with suitable adjustment of the tone ccontrols, the response at 3¾ inches per second was measured to be 40 cps to 11KC within ± 3dB. Assistance in obtaining high frequency response was gained by utilising head resonance at 11KC. Calculations show that a capacitor of 375pF shunted across the head (during replay only) will provide the necessary resonance. In my own outfit however 250pF of this was present due to shielded cables and stray capacitances. It is suggested that, if available, the head should be tuned with the aid of an oscilloscope and oscillator. A 100K grid resistor in the playback preamplifier also serves to provide the necessary damping to avoid severe peaking at the resonant frequency.

When using a 500uA meter and the nominated series resistors, good recordings are obtained if the meter does not go overscale during recording and the bias is set to read 200uA.

As a trial, 6U8 valves were substituted for the 6BL8's. Although they operated satisfactorily, crossover distortion occurred at 25 volts and the gain was not as high.

The amplifier requires a 300 millivolt signal for 30 volts output, providing a gain of 100.

(EDITOR'S NOTE: Mr Jamieson Rowe, our staff member who was responsible for the Playmaster 110 design says that Mr Robertson's fears about non-linearity in the original unit are unfounded. Tested from signal input to playback output, the distortion figures gave no hint of a basic design limitation.) ■

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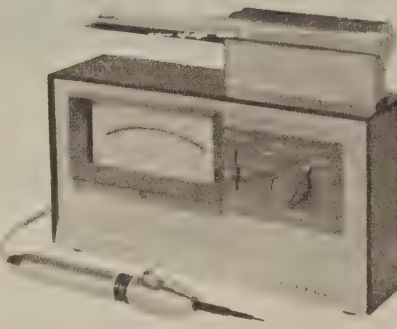

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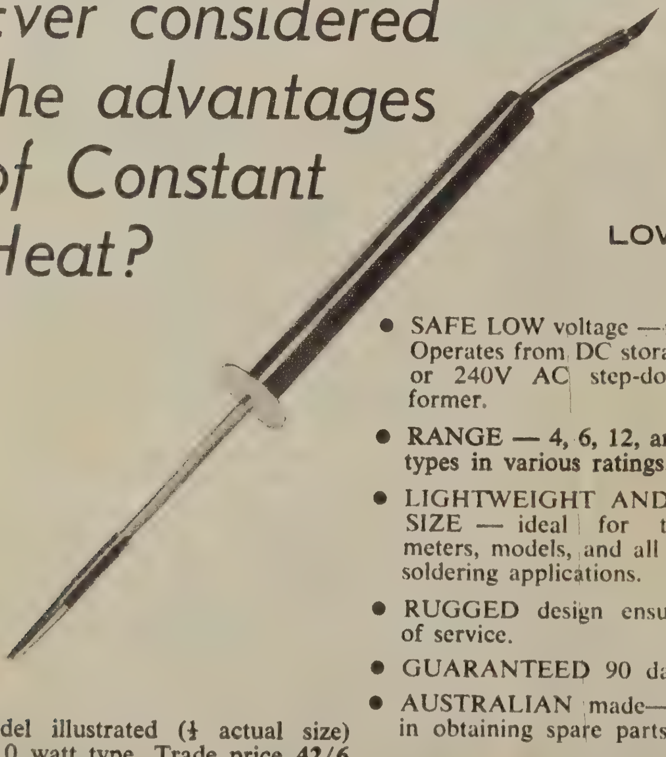

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A.B.C. COMES UNDER FIRE

Reproduced on the next page is a letter, in somewhat condensed form, from a reader who is irate about the termination of stereo broadcasting from 2FC-2BL in Sydney. He asks a number of pertinent questions but, equally, invites a few in return. In fact the letter opens the way to a number of inter-related observations.

By W. N. Williams

BEFORE becoming involved in the rights and wrongs of stereo broadcasting, using twin AM stations, I must confess to being somewhat intrigued by our correspondent's general outlook on signal sources.

His whole letter is on the basis that he and his wife are lovers of good music, yet he says: "I don't have a stereo pickup; I regard that as a trap for the purchase of stereo recordings unlimited, which I can't afford . . ."

Presumably he doesn't own a car either, because that's a trap to induce the owner to consume petrol. And he certainly wouldn't consider any form of space heating in his home, because heaters invariably trap the owner into spending money on power or fuel!

I'm sorry, but I can't help but feel that our correspondent has generated some kind of a mental block on this point. To me, reviewer or not, records are nowadays THE most obvious source of pleasure to music lovers; they contain a vast store of musical expression produced by music lovers for music lovers; they are far from being mere bait in a trap.

To be sure, many people can't afford lots of records—or prefer to spend their money on other things.

Fair enough.

Our correspondent says he can't afford records and—again—fair enough.

But, having said as much, he lists the things he **has** been able to afford—a stereo amplifier with twin tuners, high quality imported loudspeakers, enclosures, a "pretty good" mono tape recorder, tapes to keep it fed and, had not circumstances intervened, a stereo tape recorder.

I'm afraid I can't resist the observation that our correspondent seems rather to have "backed the wrong horse." Had he dispersed his "considerable" money differently, with the emphasis on a medium quality pickup and turntable, and on records carefully selected from the economy labels, he would not be facing the present blank dilemma.

My reference to "medium quality" pickup and to "economy" labels is quite deliberate and intended to underline the fact that the alternative need not have involved top catalogue prices.

Because of the hazards of AM reception, there is a very definite limit to the quality from twin AM stereo reception, and to it must be added the further degradation imposed by magnetic recording and replay.

I don't think there's much doubt that a good quality ceramic pickup, playing selected recordings from some of the economy labels, would be competitive in content and superior in quality.

No less to the point: Recordings taped off-air and retained for replay are not free; they involve the cost of tape, which is very much a consideration at the speeds normally employed for high quality recording.

Now please don't go away with the idea that I am fundamentally opposed to broadcasting, be it mono or stereo, or to tape recording and replay in any of its roles. We have given a lot of attention, through the years, to tuners and to tape systems. It's just that I can't help but protest at the way our correspondent has so summarily dismissed pickups and records.

But turning to stereo broadcasting from twin AM stations, let me ask a series of questions, all of which seem to be pertinent to the discussion:

Is the technique widely used overseas?

If it is not, why do imported equipments offer the facility?

Have they been encouraged to do it by a potential Australian market?

Have many people in Australia listened regularly to the AM stereo broadcasts?

Do they regard them as important? And satisfactory?

Is an hour or so of stereo per week worth worrying about?

Has the system any real future?

Are the listeners dismayed by the reported discontinuance of stereo broadcasting?

Have many protested to the A.B.C.?

Is our correspondent representative of a significant listener group or is he a lone voice crying in the wilderness?

I've asked the questions. Let's have some answers. The columns are open to you.

Our correspondent mentions FM-stereo that might have been.

I do not for one minute quarrel with his lament over the loss of the VHF FM band. How different the hi-fi position might have been had FM been allowed to develop.

From time to time, people mention the subject to me and then go on to speculate about the future of UHF FM-stereo. Mostly, the problem is seen to be a disarmingly simple one. If only the politicians would okay the development of UHF FM-stereo, the airwaves, in short order, would be filled with beautiful stereo sound!

I wonder? Who is going to provide all this beautiful music?

The A.B.C. might provide a program, perhaps two, later on, since it is somewhat more free to follow inclination than commercial necessity.

But if I were chief executive of a commercial broadcasting company, I would need to be convinced about the existence of a large potential audience for UHF FM-stereo; that the audience would listen, persist and respond sufficient to make the venture worthwhile.

Unfortunately, the picture presented by current broadcasting activities is far from reasssuring to any would-be provider of high-class programs.

I have the definite impression that the average broadcast station executive would be only too happy to transmit a high-quality music program, but the hard facts of audience response force the vast majority of stations to devote most of their time to material that is anything but beautiful music.

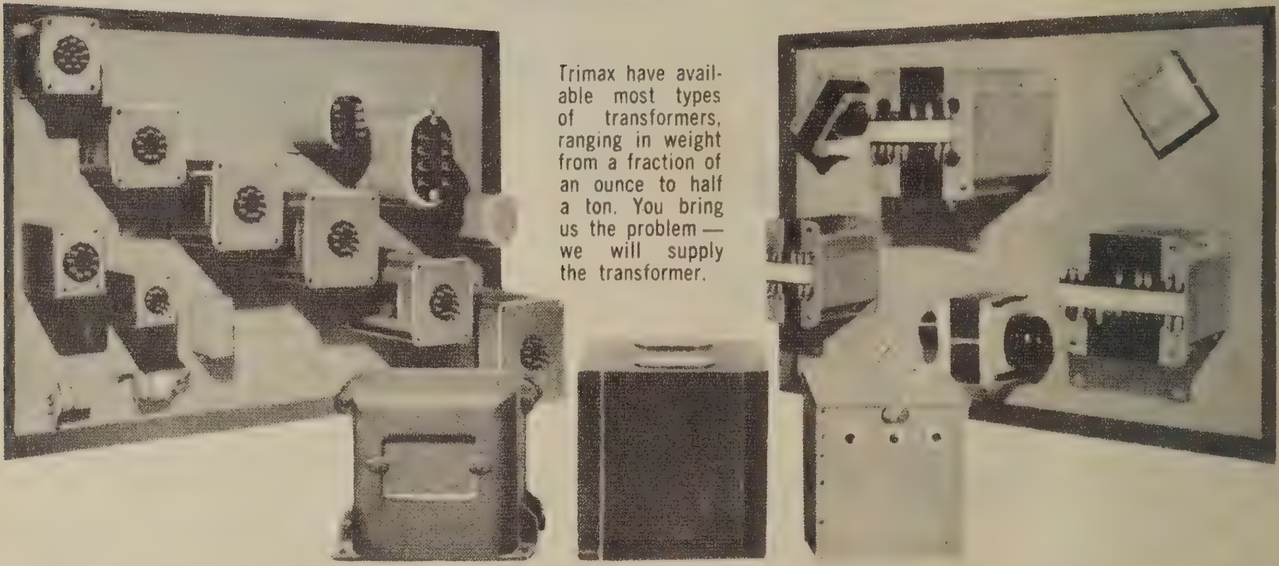
THE LISTENERS

And, from the audience end, listeners allow factors other than fidelity to dictate their choice of a receiver. As a result the vast majority of receivers make no attempt to take advantage of the quality standards observed by even our AM stations.

One must seriously question whether the mass radio audience, who appear at the moment to prefer chatter, pops and portables, is likely to switch its support to quality music and quality sound.

If it isn't, then a UHF FM-stereo service must depend on winning and

TRIMAX for a complete transformer range!



Trimax have available most types of transformers, ranging in weight from a fraction of an ounce to half a ton. You bring us the problem — we will supply the transformer.

L M ERICSSON PTY. LTD.

"TRIMAX" DIVISION

FACTORY: CNR. WILLIAMS RD. & CHARLES ST., NORTH COBURG, VICTORIA. 'PHONE: 35-1203 . . . TELEGRAPHIC ADDRESS: "TRIMAX" MELB.

LM 51

GELOSO P.A. EQUIPMENT

For the best in "sound" specify "Geloso"

GELOSO P.A. MICROPHONES

A complete range of microphones is available for all purposes. These include omni-directional, and cardiod, dynamic microphones of both low and high impedance. Wind shields are provided in many cases.

Recently released is the GELOSO "Lavalier" microphone with a response of 60-14,000 cycles. This model may also be table or floor stand mounted thus affording a very useful general purpose microphone at an attractive price.

No. 18, MEDIUM IMPEDANCE, £8/19/9
No. 19, HIGH IMPEDANCE, £8/19/9

Plus Sales Tax

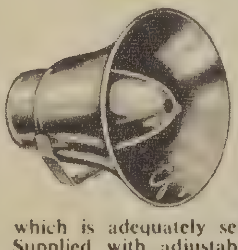
GELOSO HORN LOUDSPEAKERS

20 watt exponential horn No. 2571/A.

A medium powered horn loudspeaker intended for sound diffusion in the open air. Excellent quality.

Price: £16/7/3
Plus Sales Tax

GELOSO HORN LOUDSPEAKERS



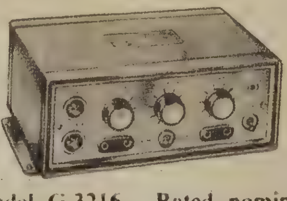
12 watt exponential Horn No. 2570

Fitted with type No. 2564 moving coil unit which is adequately sealed against water spray. Supplied with adjustable mounting.

Max. power 12 watts. Impedance 16-20 ohms.

Price £9/10/ plus Sales Tax.

GELOSO TRANSISTORISED P.A. AMPLIFIERS



Model G.3216. Rated nominal Input 12 volts. These amplifiers also rugged in construction.

A wide range of transistorised portable battery operated P.A. amplifiers is now offered by GELOSO. They range from 8 watts to 35 watts and all possess multi-tapped output transformers.

For example we quote:
10 watts maximum 17 watts output, are attractive in appearance but are

Price: £30 plus Sales Tax.

AVAILABLE FROM LEADING WHOLESALERS.

R.H. Cunningham PTY. LTD.

VIC.: 8 BROMHAM PLACE, RICHMOND. 42-1614.
N.S.W.: 64 ALFRED ST, MILSONS POINT. 929-8066.

holding a sufficient minority to make the exercise worthwhile.

It is relevant, at this point, to mention the number of people who do own higher-quality equipment, from furniture-style stereograms upward, who buy so many stereo records, stereo tapes and tape recorders. Is not every one of these a potential listener to an FM-stereo service?

Superficially, yes . . . but still I wonder.

People buy records, tapes and recorders for a number of reasons, which tend to be accumulative:

1. They want the music they provide;
2. A record or tape library is a status symbol;
3. Music they like is available to them any time they want it;
4. They derive satisfaction from being able to select their program, or follow a mood, particularly in a family or social atmosphere.

Personally, I feel that (3) and (4) are far more important than many may consider, especially (4). It provides individuals—or a group—opportunity to participate in the music or, to use a popular phrase, it allows people to become involved as and how they feel inclined.

No system of broadcasting can provide this involvement, excellent though it may be in other respects.

FREE ENTERTAINMENT

It provides "free" entertainment to be sure, and this is its strong point, but broadcast entertainment goes on relentlessly, without any knowledge of the whims or desires of the individual listener.

If this line of reasoning is valid and significant, it means that large numbers of stereo quality enthusiasts will continue to buy records and tapes and to spend much leisure time listening to them, FM-stereo notwithstanding.

To be sure they will buy FM tuners and say how wonderful they are, but will they listen to them consistently, hour upon hour, day after day, year in and year out?

If they don't, they forfeit their value and their rights as an audience. But even if they do, are their numbers great enough to support a whole new branch of the entertainment industry?

After all, stations count their success, not on the number of people who own tuners, but on the listener-hours they compile and, in the case of commercial stations, the commercial responsiveness of the audience.

I can well imagine that, by this time, some readers will have generated substantial fury, as I seemingly assume the role of a traitor to their cause.

I seek however, to be realistic in not basing judgment on what I believe to be false premises or starry-eyed assumptions.

I believe that Australia must have — ultimately will have—an FM-stereo service, probably in the UHF band, as envisaged.

But equally I believe that such a service could not grow strong on the partial support of the present-day minority of hi-fi minded listeners.

It will need full-scale backing and promotion as a new venture of the electronics-cum-entertainment industry, with a large element of re-education.

It will need mass conversion among those who are currently devotees of mantel sets, portables and goggle-boxes.

If this seems like a tall order, don't be unduly pessimistic. As monochrome television runs towards saturation, the electronics industry must find a new outlet for its activities, or stagnate and become an embarrassment to the Federal Government in more ways than one.

Colour television has commonly been tipped as the basis of the next big move but this is not by any means an automatic decision. Technically it is entirely feasible, but economically it represents a headache which most television executives would be pleased to do without for the time being.

Against this background an FM system, with stereo as an option, could easily assume very attractive proportions to the equipment industry, to the Government and to the retail trade alike. Should this come about, we could find ourselves literally surrounded by advertisements extolling the virtues of the wonderful new entertainment medium!

WHY HAS STEREO BEEN DROPPED?

Dear Mr Williams,

I have just written a long and not very complimentary letter to the Director of Programs, Australian Broadcasting Commission, the subject being the Commission's abolition of stereo broadcasting. Admittedly, it was only 45 minutes a week and the music didn't always appeal to me. I feel, though, that its discontinuance is a most retrogressive move.

Some months ago, when I decided it was time to review my radio receiver set-up, I had practically made up my mind to purchase a Playmaster 101 incorporating AM and SW tuners. Having in mind, however, that the A.B.C. was broadcasting stereo on Monday nights together with an occasional Wednesday night B.B.C. drama in stereo, I switched to a Pioneer tuner-amplifier as it had AM-AM tuners.

The Pioneer has certain disadvantages for Australian conditions but the fact that there were stereo broadcasts swung me to it. In fact, I heard but one B.B.C. stereo drama before they were discontinued . . . its effect was terrific, it turned our loungeroom virtually into a stage. Well, that was that! Now, they've cut out stereo music to make way for Arch McKirdy "across the board."

I don't have a stereo pick-up; I regard that as a trap for the purchase of stereo recordings unlimited, which I can't afford. (Pity we cannot all be record reviewers, hi!)

My wife and I being lovers of good music, I've a pretty good tape recorder which I use to tape much of the A.B.C.'s broadcasts (mono). I was just about at the point of trading in the recorder for a stereo job so I could record the stereo broadcasts . . . fortunately, I had not done so when the stereo stopped.

Now then . . . what about all the AM-AM tuner-amps already sold? What about all the hundreds, Pioneer, Sansui, Trio, still in stock? How are the dealers going to sell them to the customers? Sell them on the inducement of being able to hear Parliament and a Symphony at one and the same time?

What about all the stereo recorders ditto? Sure, they can be used to play pre-recorded stereo tapes . . . but they cost more than stereo records! After one or two stereo tapes made with microphones for the novelty of the thing they'll no longer be used much for that purpose. From where I sit, I can see their most practical use as being for making stereo tapes from air broadcasts.

(Again, not all of us are reviewers with free pre-recorded tapes coming our way . . . don't misunderstand me, I'm not the slightest bit bitter about this thing!)

Seriously, though, what about this? If this is the A.B.C. "New Look" I don't think I like it.

The fact is, of course, if we were not so unfortunate as to have such a dunder-headed Federal Government (or their advisers in the P.M.G.'s Dept.) we'd have FM radio broadcasting duplex in stereo most of the day and night. As you know, that is the way things are in the U.S. and Europe; I seem to remember being told by someone that Western Germany has now more FM than AM stations.

First, they wipe FM, now they wipe stereo!

Some time ago the A.B.C. went to a lot of trouble to conduct a survey on listeners' taste in plays; so far as I know, they made no effort whatsoever to ascertain how listeners felt about stereo broadcasting.

I suggested there were probably more than a few people like myself who had spent considerable money on equipment including Wharfedale Super speakers in enclosures purely for the enjoyment of good sound.

Are we to say: "Oh, well, it was good while it lasted"? Or do we squawk loud and long? I would think you'd have all the importers and dealers with you if you started a campaign of protest.

If we can't have stereo for half-an-hour a week from 2FC and 2BL, and the Government is too frightened (of what?) to authorise FM, or too influenced by some unknown powers, then to what use is the 1800-1650KC band being put? Apart from the fact that 2UV has transmitters in Sydney, Wollongong and Newcastle on 1750KC, I don't know. If we could have regular stereo in this band it would be a proposition to rig up a couple of transistor converters for our AM-AM tuners.

What do you think of this aspect of A.B.C. policy?

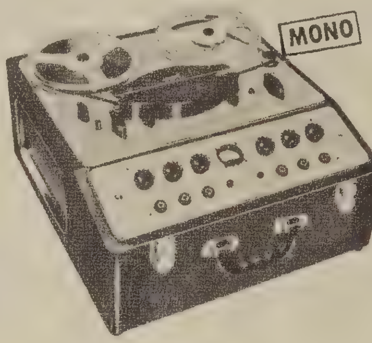
All the best to you and "E.A.,"

Sincerely, B.C. (Hornsby, N.S.W.).

Tape your own
Programmes
Mono or Stereo
with crystal-clear

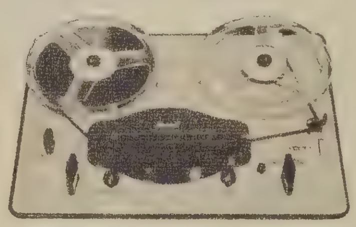
Brenell

Britain's finest Tape Recorders and Tape Decks designed for the Connoisseur.

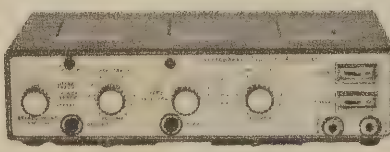


MARK 5 TYPE M.
A semi-professional tape recorder giving mixing, superimposing, monitoring facilities. Separate amplifiers for recording and playback accurate level meter ensures unvarying quality recordings.

STB1/5/2.
Incorporates twin recording amplifiers; twin replay pre-amplifiers, half-track mono stereo recording facilities; plus half-track and quarter-track stereo facilities. Designed for use with all makes of high quality amplifying and Hi-Fi equipment.



MARK 5, SERIES 2 TAPE DECK.
Produced for the tape recording connoisseur, the Brenell Mark 5 Series 2 Tape Deck, with its skilful design and top-flight engineering, is simple and reliable. Just two switches control Record, Playback, Wind and Rewind and a pause mechanism, plus a special switch for superimposing. Invaluable for recording speech with music or for adding a musical background. The Deck is supplied fitted with either ¼ or ½ track stereo Erase and Record Playback heads.



STEREO TAPE PRE-AMPLIFIER UNIT.
Precision built and simplicity itself to operate, the pre-amplifier is designed for use with the Brenell Deck or quarter and half-track stereo decks. It incorporates Ferroxcube Oscillator, 4-speed Equalisation, Signal Level Meters and Gain Controls. Instantly it adds full stereophonic recording facilities to your existing stereo equipment.

RCA OF AUSTRALIA PTY. LTD.
An associate Company of Radio Corporation of America.

SYDNEY: 221 Elizabeth Street. 61-8541
MELBOURNE: 2 Stephenson Street, Richmond. 42-4586
BRISBANE: 173 Ann Street. 2-7884
PERTH: 280 Stirling Street. 28-5057
ADELAIDE: Newton McLaren Ltd., Leigh Street. 51-0111

MAIL THIS COUPON TO YOUR NEAREST RCA DEALER FOR BROCHURE OF ALL MODELS!

Please send me detailed brochure on:

☐ Deck & Stereo Pre-amplifier ☐ Stereo Recorders ☐ Mono Recorders

(tick as required)

Name

Address

RC.158.102a

By all means let hi-fi enthusiasts put their own case to their Parliamentary members, along with country listeners not properly served by AM, but representation is best made in the full knowledge of the factors involved.

Thinking which is patently starry-eye and unreal, is easily dismissed as such, and undermines, rather than strengthens a cause.

I think I should add here that these remarks are not levelled at our present correspondent, for I've taken the matter beyond the content of his letter.

He just happened to provide the catalyst!

A reader, N.L., from Oyster Bay, N.S.W., draws attention to an advertisement on the inside back cover of the August issue. He says:

". . . it carries an advert. for a pick-up arm incorporating a device stated to maintain an even pressure on both sides of the groove wall.

Customs, Excise

Dear Sir,

The August issue of Electronics Australia carries a letter from Mr W. R. Adey, of the University of California, Los Angeles.

Whilst Mr Adey appears to have evolved a successful "do it yourself" formula with reference to how to get components in duty free, we would like to point out one or two other facets of this transaction which were not mentioned in his letter.

At the outset, Mr Adey's letter to the Minister for Customs and Excise also carried copies to the Prime Minister and the Wireless Institute of Australia, and, although this executive did not agree with the side issues raised by Mr Adey, which concerned the Customs Department in South Australia, and were derogatory in the main, we decided to support his application on the behalf of Mr H. N. Bowman.

Accordingly a letter was sent to the Minister for Customs on the 17th May, containing our own brand of argument, and were favoured with a reply on the 1st June as follows:

"I refer to your letter of the 17th of May, 1965, concerning the request by Mr H. N. Bowman for the duty-free admission of a Collins high frequency radio filter.

"Inquiries carried out by my department in regard to this matter are now complete and I am pleased to advise that I am able to approve duty-free admission of the filter concerned under By-law Tariff Item 449(A)(2).

"I have arranged for formal advice of my decision to be forwarded to Mr Bowman and to the Collector of Customs, South Australia."

A copy of this letter was also sent to Mr Bowman, and we presume everyone was happy ever after. The part the institute played in having the original decision reversed cannot be accurately gauged, but we would like to think that it was not inconsiderable.

Although the moral of all this may point up the need for more effective Institute publicity at the Federal level, we would also like to make it known that the Federal Executive is active on behalf of any amateur with any request, whether it be administrative within the Institute, or concerning other authorities

Peter D. Williams, VK3IZ
Federal Secretary.

"Now I think there is a lot of rubbish preached in regard to record playing and this is more of it.

"As a purely physical matter, surely the gadget, as described, is going to increase the pressure on the outer wall and only increase whatever infinitesimal difference may exist between the pressures on the two walls.

"Perhaps you would care to comment on this in your Forum column."

I don't mind if I do, but I'm afraid that N.L. is due for a disappointment.

To minimise tracking error, all pickups have a bent arm or offset head shell and are so positioned that the axis of the stylus is substantially parallel to a tangent to the groove at the point of stylus contact. In most cases, this keeps the tracking error down to a few degrees, which is a very commendable result.

There is a complication, however, in that, as the groove passes beneath the stylus, it imposes a drag on the stylus in the direction of the tracking line and this line does **not** pass through the base pivot.

The geometry of the system is such that the stylus drag tends to pull the arm inward, and this produces slight additional pressure against the inner wall of the groove. Therefore, our correspondent's basic assumption that the system applies equal pressure on both walls is not correct.

The counterweight system, to which attention is drawn, is an attempt to offset the inequality and, ideally, it should improve matters.

Unfortunately, because drag varies with groove velocity, and therefore groove diameter, it is difficult to apply more than an "average" order of correction.

Is it worth while?

In medium quality players it probably isn't, because the stiffness of bearings and other limitations of the system may swamp any second-order effects arising from tracking torque.

However, in high-quality systems, where other imperfections have been reduced to a minimum, it becomes more logical to show concern about inequality of groove wall pressure. In fact, the system is used fairly widely by "perfectionists"—by some as a precaution, by others because they claim they can hear the difference.

This discussion could doubtless be pursued further into the realm of subjective judgment, but this is not necessary for the present purpose. Sufficient to say that the gadget shown in the advertisement is based on technical fact.

FM STATIONS

Set out in the panel above is a letter from Matrix Laboratories, which will be of special interest to those who have followed the "progress" of FM broadcasting in Australia.

It should be stressed that the two stations will operate under a licence far more experimental—in fact—than that which covered the P.M.G.-operated transmitters. They will be occupied with investigating techniques in an unfrequented portion of the spectrum and will have no program or schedule responsibilities to casual listeners.

If there is comfort to be drawn from their existence, it would be on the basis that the people concerned are not sponsoring these stations for the good of their health. It is reasonable to assume that they have an eye to the future. ■

EXPERIMENTAL UHF FM STATIONS

Dear Sir,

We wish to advise regarding the coming experimental FM transmissions in the Melbourne area.

The Postmaster-General's Department granted the licence to conduct test transmissions in the UHF band using frequency modulation.

Technical details are as follows:

Call sign:	*VM3Y.*
Frequency:	*554MC ±0.002 per cent.*
Bandwidth:	*200KC.*
M.E.R.P.:	*500 watts.*
Deviation:	*± 75KC (proposed).*
Pre-emphasis:	*50 Microseconds.*
Polarisation:	*Horizontal, cross-polarisation envisaged.*
Modulation:	*FM monaural and FM stereophonic.*
Stereo System:	*FCC (America) Pilot tone system.*
Transmitter location:	*The Olinda area of the Dandenong Ranges.*

The purpose of the experiment is to investigate the following:

(a) What are the problems associated with the use of the UHF band for FM-stereo broadcasting services?

(b) Is the use of elliptical polarisation to fill dead spots in coverage, necessary? Will it make reception practical in portable and mobile receivers?

(c) What are problems associated with stereo and SCA systems when used with UHF transmissions?

(d) What receiver design would be most suitable for UHF stereo transmissions?

(e) To what extent is public interested in FM radio services?

The experiments will not include the transmission of advertising matter, or simulate commercial broadcasting in any form.

It is anticipated that pre-recorded music and speech will form part of the test conditions. It is hoped to commence transmissions within three to four months.

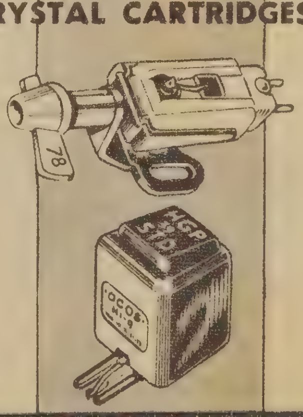
We have received a number of inquiries from people living in the Sydney area. We would advise that a similar experimental station is being set up in Sydney. For further information please contact Mr Ray Allsop, P.O. Box 3998, G.P.O., Sydney, New South Wales

As our allocated frequency is in the UHF band it should be noted that standard FM tuners (88-108 Mc/s) will not be suitable for reception. A number of people have asked about a converter for this type of FM tuner and we are currently looking into this problem. It is proposed to make available on request, full details of a suitable converter for this purpose. A prototype unit is now under development. We understand that two leading Australian manufacturers are studying the antenna situation.

Due to the volume of letters we have received it was not possible to answer each one on an individual basis. Future correspondence will be in the form of a newsletter to those who are interested. Information or comments relating to the FM scene would be welcomed for possible inclusion in this newsletter.

Yours sincerely,
Matrix Laboratories, P.O. Box 30, Toorak, Victoria.

ACOS **REPLACEMENT CRYSTAL CARTRIDGES**



GP67-1G. A high-quality monaural turnover cartridge with an extended frequency response and excellent tracking capabilities. A standard replacement crystal cartridge for most players and changers. Replaces HGP37 and GP65 series. Standard ½" mounting bracket. Price: £2/18/6.

HGP39. Crystal cartridge. Available for standard or L.P. recordings for use with HGP20 and HGP40 Pick-up Arms.
Price Single Sapphire Stylus, £3/12/6.
Single Diamond Stylus, £5/13/6.

Sole Australian Agents:
AMPLION (A'SIA) PTY. LTD. 29 Majors Bay Rd., Concord.
Sydney, N.S.W. Phone 73 1227
Victorian Distributors:
E. W. Cornelius Pty. Ltd., 5 Northumberland Street, South Melbourne, VICTORIA

SPECIAL PURCHASE OF FACTORY STOCK

RESISTORS, CONDENSERS AND POTENTIOMETERS

We have purchased the resistor and condenser stock of manufacturers including S.T.C. and Stromberg-Carlson who have ceased the maufacture of television and radio receivers and can offer same at less than 25 per cent of list price.

The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg in ½, 1 and 2 watt ratings and include some wire wound resistors. List price, £4/10/ per 100. **Our Price, 20/ per 100.** Post and packing, 2/6 extra.

The condensers are in most popular makes and include mica, ceramic, paper and electrolytic in standard values. List price, £5/10/ per 100. **Our Price, 20/- per 100.** Post and packing, 3/6 extra.

The potentiometers are all current types and include switch pots, dual concentric and THB pots. List price, £6 per dozen. **Our Price, 25/ per dozen.** Post and packing, 2/6 extra.

FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Valve Type 6U7G or 1T4 or One New English Miniature 11 x 1 Switch as advertised on this page.

New English Miniature 11 x 1 Switches

These new miniature eleven-position single-bank switches are 1" diam. with ¼" spindle, they have silver-plated contacts and high quality insulation suitable for H.F. use.

4/9 each. Post and packing 1/6.

NEW GARRARD RECORD CHANGERS

These New English Garrard Changers with High Fidelity Crystal Pick-ups and Sapphire Styli have just been superseded. We are selling same at LESS THAN HALF PRICE. Available in STEREO at £12/15/. POST AND PACKING EXTRA N.S.W., 15/; QLD., VIC., TAS., 22/6; W.A., S.A., 30/.

HIGH-SPEED 240V. AC/DC MOTORS

These 240 v. a.c. or d.c. motors are 1/8 H.P. with a speed of 7,000 R.P.M. and are ideal for small drills, grinders, etc. Dimensions, 5½in x 3½in. with 5/16in spindle 37/6
Post, N.S.W., 5/; Interstate, 8/6.

NEW 4-SPEED STEREO PLAYER F.O.R. £8/15/0

NEW STEREO CHANGER. 4-SPEED F.O.R. £10/15/0

SLIDER-SWITCHES
10 pole 2-way silver plated contacts 3/9

TYGAN AND SARLON SPEAKER GRILLE FABRIC

54in wide. List price 60/- per yard. To clear at 40/- per yard.
Postage and packing N.S.W., 3/6; Interstate, 4/6.

LEADER SIGNAL GENERATOR LSG11

240V A.C. operated, 6 band 120KC to 390 Megs Provision for crystal.
Post N.S.W. 7/6; Interstate 12/6. £15

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp., 37/6. Post, N.S.W., 2/; Interstate, 2/. Transformer for above rectifier tapped for 6 or 12 volt, with circuit for charger, 47/6. Post, N.S.W., 7/6; Intestate, 10/.
As above, 6 or 12 v., at 2 amp., 27/6. Post, N.S.W., 3/6; Interstate, 4/6. Transformer for above, 37/6. Post, N.S.W., 3/6; Interstate, 4/6.

NEW 240V. A.C. MOTORS

These small motors, size 3in x 3in x 3½in, are 1-12 h.p. but are only suitable for intermittent use. 29/6. Post N.S.W. 3/6; Interstate 5/.

THE NEW COLLARO 3-SPEED TAPE-DECKS 2 & 4 TRACK

The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

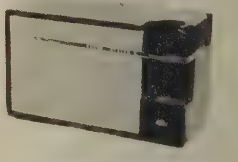
● 3-speed 1⅞, 3¾, 7½. ● Pause control. ● Takes 7in spools. ● Simplified controls. 4 Track, £24; 2 Track £22. OSC Coils, 15/.

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools.
2 Track, £17/15/; 4 Track, £22/12/6.

NEW 4" EXTENSION SPEAKERS

These 4" speakers are mounted in polished cabinets suitable for use as intercom. units or extension speakers.
LIST PRICE .. .. £6.
SPECIAL PURCHASE ENABLES US TO SELL THESE UNITS AT 40/. Post and packing, N.S.W., 6/9; Interstate, 9/9.



NEW ELECTROLYTIC CONDENSERS AT LESS THAN HALF PRICE

0 mfd - 30 mfd 400v.	9 6	70 mfd + 25 + 5 + 5 400v W	12 6
100 mfd - 200 mfd 350v.	12 6	8 mfd 400v pig tail	4 6
50 mfd 12v	2 0	16 mfd 400v	5 6
64 mfd 350v	7 6	25 mfd 25v	2 9
16 mfd - 8 mfd 300v W	7 6	100 mfd 350v pig tail	9 6

POST EXTRA

NEW AMERICAN TWIN TELESCOPE TV AERIALS

Extends to 36in each section can be used singly for car or portable radio. 20/
POST 2/-.

25 WATT £26/17/6
17 WATT £21/17/6
Post Extra on 15 Watt N.S.W., 10/; Interstate, 15/.
25 Watt by Rail or Air. Too Heavy, for Post.

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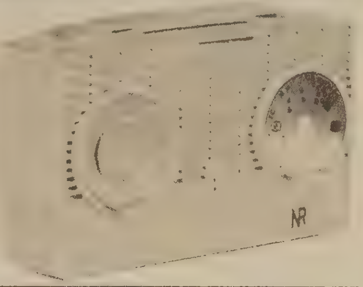

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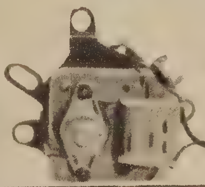

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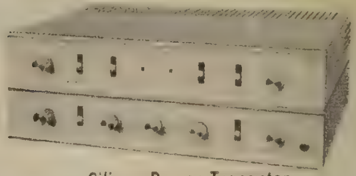

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WHAT ARE WATTS?

From time to time, reference has been made in these columns to the subject of amplifier power ratings and the way they have become confused by technical misunderstanding and exaggerated advertising. This excellent summary of the present position should assist those of our readers who have not quite caught up with the facts.

By G. W. Tillett*

I DO not suppose anything has caused so much confusion in the Audio world as this question of power output. When highly qualified engineers talk (and argue) about rms sine wave power, peak watts, continuous power, IHFM and EIA Music Power, etc., etc., it is no wonder that the man-in-the-street scratches his head in some bewilderment. Gertrude Stein could have said, "A watt is a watt is a watt" but she would have been quite wrong!

Some years ago I asked a well-known American audio engineer how they managed to extract such high outputs from some of their amplifiers. I pointed to an advertisement which claimed no less than 40 watts from an amplifer using EL84 type valves. I said we both knew that the valve makers in their modesty rated these valves at 17 watts per pair — and this without transformer losses; so where does the 40 watts come from?

"That's easy," said the engineer, "I know this particular amplifier quite well; it will certainly deliver 15 watts all right but under overload conditions it will, I suppose, put out something like 20. Multiply this by two to get peak power, and there's your 40 watts. But of course no distortion figures are mentioned. Top American firms do not use this kind of arithmetic; in fact, they are as meticulous in their specifications as you are here."

This is perfectly true of course, and here I am thinking of such well-known names as Fisher, Acoustech, McIntosh, Heath, Marantz, Scott, Sherwood, etc. These firms are not only precise in their performance claims but they give far more technical details concerning their amplifiers than most British manufacturers. But what about all those terms —sine wave watts, rms, peak watts and so on?

"The question is," said Alice, "whether you CAN make words mean so many things?"

"The question is," said Humpty Dumpty, "which is to be master — that's all."

Very true, so without further ado we will proceed with some definitions.

AMG. The British Audio Manufacturers Group, who have been trying to introduce some amplifier standards and test procedures. Unfortunately, this body has not yet obtained full support of the industry — but we may hear more of the AMG in the near future.

IHFM. The American Institute of High Fidelity Manufacturers, who initiated standard methods of amplifier measurements back in 1958. There is no doubt that the IHFM have done a great deal to bring order to a somewhat chaotic situation.

EIA. The Electronic Industries of America, who have also evolved various standards, but the EIA ratings are more generally used by "medium fi" systems, electronic organs and public address equipment.

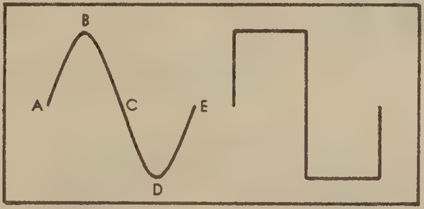

FIGURE 1: ***In a sine wave (left) the amplitude rises to a maximum at B, falls to C then changes polarity and completes its cycle through D to E. By contrast a square wave (right) is virtually at full amplitude all the time.***

SINE WAVE. The waveform of a pure tone at a single frequency. Single frequency waveforms are easily obtained from audio generators.

But such pure notes are not often met in music; the waveform of an orchestra in full swing is very complex indeed. Nevertheless, sine waves are extremely useful to the audio engineer in his measurements of amplifier frequency response and performance generally.

SINE WAVE WATTS. The power output of an amplifier fed by a sine wave signal from an audio generator. The usual test frequencies are 400 and 1,000 cps and the output power is read on an AC wattmeter or voltmeter.

RMS. The cryptic letters mean root-mean-square which is a mathematical expression meaning effective value. Most AC meters are calibrated to give an RMS reading which is the truest indication of real power.

The sine wave power of an amplifier should be related to the distortion. Therefore a typical specification might read—"Power Output, 10 watts RMS at less than 0.1% distortion."

The IHFM definition states "the sine wave single frequency power output shall be the greatest power at the rated distortion which can be obtained for a period of not less than 30 seconds . . . the standard frequency is 1,000 cps."

The AMG definition is very similar, but the EIA quote a distortion figure of 5%. Most hi-fi amplifiers have a distortion figure of between 0.1% and 1% at rated output so the EIA power rating will naturally be higher.

The RMS sine wave rating is also referred to as steady state power, continuous power, solid watts and hard watts. (I have not heard a definition of "soft watts.")

PEAK POWER. The current in a sine wave is not flowing at maximum all the time. So, if we want to know the maximum power output of an amplifier we must feed it with a square wave. With this sort of waveform, the amplifier is really putting out power all the time. The output is read on a peak-to-peak type of AC meter.

Another way of finding out the peak power figure is simply to multiply the sine wave power by two. Peak power ratings are quite popular in America, but here their use is mainly confined to guitar amplifiers. I have a Charing Cross catalogue before me which quotes all amplifiers like this: ". . . output power 14 watts British, 28 watts American," as if American watts were twice the size of British watts—or maybe it is the other way round! Incidentally, peak power rating is known in some circles as "Squawk Power."

MUSIC POWER. If we feed a sine wave signal to an amplifier and then, after maximum output is reached (just before the waveform becomes clipped or distorted as viewed on an oscilloscope), we increase the input still further, what actually happens? The answer is this: the output stage current increases and if the amplifier has a poorly regulated DC power supply the voltage falls and the output stages cannot handle the extra signal. But if the amplifier DC supply is disconnected and an external stabilised DC power unit is used instead, then the voltage will remain constant and the amplifier can give a higher output before overloading occurs.

On the other hand, if the increased signal was not a sine wave but merely consisted of transient peaks of a few milliseconds, typical of a music waveform, then these could be handled by the amplifier with its own skimpy power supply quite comfortably. In other words, the peaks would not last long

---

* Mr Tillett is Technical Director of Wharfedale Wireless Works Ltd., Leeds, England. The article was offered by the author for publication in "ELECTRONICS Australia" and is published by courtesy of "The Gramophone," in which it originally appeared.

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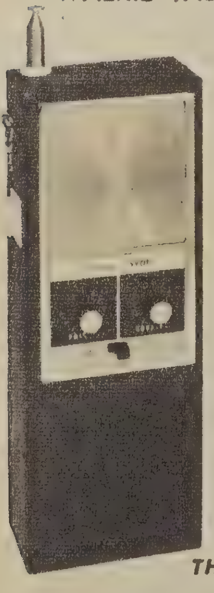

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enough to affect the DC supply, so the voltage would remain constant. All this means that amplifiers could be designed with smaller power supplies and a 5 watt sine wave amplifier could be rated at 10 watts "Music Power."

This principle was used in the Mullard "low-loading" valve amplifiers some years ago, but the idea is particularly attractive for transistor amplifiers as it enables the overall dissipation of the transistors to be reduced and so the cooling devices, the large hunks of metal called "heat sinks," can be much smaller.

Most transistor amplifiers use a "Class B" circuit which means that the output stage current varies according to the power output, that is, it is changing all the time. But the voltage must be kept constant, so the designer is faced with the alternatives of providing an elaborate and expensive stabilised DC supply or having a smaller unregulated supply, using high value capacitors, capable of giving a voltage which will not fluctuate under music power conditions. As an engineer would say, the simpler power pack is not stabilised but it has a long time-constant.

The IHFM definition of music power states that it must be measured in the same way as sine wave power but "the significant supply voltages must be held as constant as they were under no-signal conditions." This means that an external stabilised power unit must be employed.

Peak music power is obtained by multiplying the ordinary music power figure by two.

Summing up then, it would seem that music power ratings not only appear to be a more logical method of assessing the performance of amplifiers under working conditions, but they give the advertising people higher figures to juggle with into the bargain.

There must be some snags. There are indeed. First, extra care must be taken when testing such amplifiers with sine wave signals, especially if an external supply unit is used, as the transistors on their small heat sinks may overheat and so die an untimely death.

Second, and perhaps of greater importance from the average user's viewpoint, is the fact that there is no agreement as to how long the aforementioned transient peaks shall be. For instance, peak powers of some organ works like Bach's Toccata and Fugue in D are quite long; and how about those tremendous climaxes in Vaughan Williams' Sea Symphony?

The truth is, some amplifiers will pass the test, others will not. The only safe guide is to judge by the sine wave figures and to bear in mind that the music power ratings should not exceed the RMS figures by 30% — or 50% if the amplifier is a large one with plenty of power in reserve.

POWER BANDWIDTH. Many amplifiers will give their rated output only at the centre of the frequency range. Thus an amplifier using a cheap output transformer might deliver its promised 10 watts at 1,000cps but only four at 60cps and just about the same at 10,000cps. Such an amplifier would have a weak and muddy bass response and the treble distortion at high volume levels may be only too apparent.

The IHFM take care of this situation by defining a Power Bandwidth measurement. This is given as "the range between the highest and lowest frequencies where the distortion is the same as at the maximum rated figure for 1,000cps, but at half power levels." A good amplifier might have "half-power" extremes at 20cps and 20,000 cps, and some of the latest transistor amplifiers are even better.

Power bandwidth must not be confused with frequency response, which is usually taken at a very low volume level. It is quite possible for an amplifier to have a frequency response as straight as a ruler from 10cps to 50,000 cps and beyond, but the power bandwidth might only extend from 60cps to 5,000cps.

This just about covers power definitions and ratings in common use, but it will not be inappropriate to devote a few words to stereo amplifier measurements and load impedances. For stereo amplifiers, the EIA state that each channel can be measured separately, but it is obvious that this is not realistic. Both channels should be driven simultaneously, and amplifier tests are carried out in this manner by the American Hirsh-Houck laboratories.

The point concerning load impedances really only applies to transistor amplifiers having transformerless output stages. This type of amplifier will only give full output at one particular load impedance. A variation of 6 to 10 ohms for a nominal amplifier impedance of 8 ohms would not cause appreciable loss, but increasing the load to 15 ohms may well result in a power reduction of 30%. The moral is, check that the amplifier will match the speakers you will be using.

CONCLUSION: Music Power Ratings: I would like to see Music Power Ratings more accurately defined in relation to the time factor.

Power Bandwidth: It seems to me that this measurement puts the cart before the horse. It tells the customer what power he can expect at a specified distortion level, but it does not tell him what the distortion is at the full output — except at 1,000cps. In other words, if a man buys a 10 watt amplifier he is entitled to know what the distortion is at 10 watts at, say, 40cps and 10,000cps—or if the amplifier will even deliver 10 watts at these frequencies!

Sine wave watts: Should be quoted for 30 or 40cps and 10,000cps with the distortion figures, in addition to the standard 1,000cps measurement. AMG please note. ■

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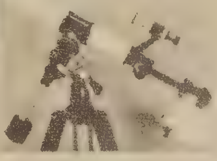

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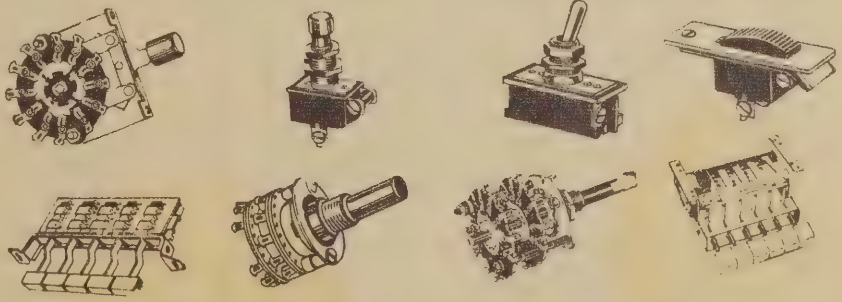

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JANACEK—"Diary of a young man..."

JANACEK. Diary of a young man who disappeared. Beno Blachut, tenor. Stepanka Stepanova, alto. Josef Palenkek, piano. Female Chamber Ensemble. Conductor, Jan Kuhn. Supraphon. SUA 10228.

Some years ago I reviewed a recording of this work, sung in German, with Ernest Haefliger, Kay Griffel and Rafael Kubelik. I was struck by the power and originality of the work and by the performance but, equally, I had seen statements that one should not finally evaluate the work until one had heard it sung by Blachut in Czech. Well, the record has now come to hand and it is remarkable.

Leos Janacek was a native of Moravia, born in 1850, who died in 1928. He matured slowly as an artist and did not produce any significant music until he was over 40. His first great success was his opera Jenufa in 1916. His music is based on Slavonic folk lore and native mysticism.

In his vocal music, which is thought to be his strong suit, he aspired to a plastic melody moulded to the rhythm and natural inflections of speech; harmony is extremely mobile. He had little interest in traditional forms, preferring a structure based on continual variations. In his later works he dispensed with key signatures. He has been compared to Moussorgsky for his sometimes rough but always original harmonies and the love of humble folk which distinguishes his art.

The poems of the work tell of a country lad who became infatuated with a gipsy girl. The rustic scenes and sounds are wonderfully evoked in the strange music, as are also the boy's feelings. He feels ashamed to be sitting with his parents and sister, but finally his feelings compel him to leave his home and go off with his love, who now bears him a son.

It is certainly one of the great song cycles; in fact, it is almost like a miniature opera. The music is difficult to describe and I am told that it is strange to look at.

Blachut sings the young man's part with extraordinary skill, constantly varying his tone and rising to a remarkable outburst of passion at the end. Stepanova is most alluring as the gipsy and the strange chorus of three female voices lends a most eerie touch to the work. Palenicek plays the piano part with great skill.

Hearing the work in Czech makes a world of difference. A copy of the text in four languages is provided and it should be of the geatest interest to lovers of the unusual in music. (The recording, by the way, came from Allans Music (Aust.) Pty. Ltd., 276 Collins Street, Melbourne.)

TCHAIKOVSKY—Symphony No. 6

TCHAIKOVSKY. Symphony No. 6 in B Minor, op. 74. (Pathetique.) The Vienna Philharmonic Orchestra. Conductor: Lorin Maazel. Decca. Mono. LXTA.6164. Stereo. SXLA.-6164.

In 1892, four years after the completion of the 5th Symphony, Tschaikovsky started on another but it went badly and he soon abandoned it. However, the following year, he mentioned in a letter to his nephew that he had started on a new symphony "which will remain an enigma to everyone." He went on to say that the finale would not be an Allegro but an Adagio of considerable dimension. The work went well and was finished and performed in October, 1893. It was well received.

As in the third and fourth symphonies, the mood of the whole work is set in the introductory passages, with the bassoons and double bases just stirring in the depths of their profound misery. When the movement proper starts, it is with a theme based on the introduction. The second theme is famous and is ushered in by a solo passage on the 'cellos. The development section begins with a terrific impact but the movement gradually returns to the pathos of the opening.

Then follows a strange waltz in 5-4 time which is a kind of danse macabre, with a sinister pedal note on the tympani in the Trio.

The march-like third movement is a perfect example of the composer's skill in creating a long and elaborate movement by the endless repetition of a few melodic snatches. The last movement returns to the sombre pathos of the beginning and the work finally sinks away to nothingness.

Maazel has always been a most gifted conductor, and his reading of the work, though highly exciting, belongs to the very controlled school of Toscanini. The rhythmic precision and overall discipline are always admirable. The string tone of the famous Vienna Philharmonic is full and rich and the numerous brass passages are always in tune.

Altogether a record to be highly recommended.

★ ★ ★

BRAHMS. Symphony No. 2. Boston Symphony Orchestra. Conductor: Erich Leinsdorf. R.C.A. Stereo LSC-2809.

The first symphony of Brahms is a noble and tragic work. Although the composer did not attempt to write a work in this form until he had learnt all he could of the counterpoint of Bach and the structure of Beethoven, the work was not well received at first.

It must have been a relief to turn to the sunniness and joy of the second symphony.

The first movement starts at once with an almost pastoral theme and this is the prevailing mood of the whole work, although the second movement at times becomes introspective. However, this is quickly dispelled by the third movement with its charming theme for the oboe. This is soon interrupted by the strings but the listener will note that this is really the same theme in a different rhythm and at a different pace. The last movement continues in the same happy mood and there is a brilliant coda in which the trombones are prominent.

I think the Boston Symphony is one of the best orchestras in the world. Each section is good and they play splendidly in tune. I have never found Leinsdorf a particularly sympathetic conductor, however. I think he misses some of the finer, more delicate points and the climaxes could have more authority. The recording is excellent.

★ ★ ★

RICHARD STRAUSS. Daphne Arias. Four last songs. Teresa Stich-Randall. Vienna Radio Orchestra. Conductor, Laszlo Somogyi. Westminster. Mono. XWN-19081.

Daphne is one of Strauss's later operas and is seldom performed. It is called a pastoral tragedy in one act and concerns the infatuation of Apollo for Daphne, a country girl who has a rustic admirer named Leukippos. When the two mortals try to persuade Apollo to reveal who he is, he strikes Leukippos dead with a thunderbolt. Then, moved to pity for Daphne's grief, he changes her into a laurel tree. It sounds as if it would be rather difficult to do convincingly on stage.

Teresa Stich-Randall sings the various arias which Daphne has but they are impossibly high, hovering all the time round top C, and truly representative of Strauss. For the most part, Stich-Randall sings in tune but her voice is colourless and devoid of vocal inflections. The whole performance sounds very strained.

The reverse side is taken up with the wonderful Four last Songs but there are other recordings which are much more convincing. The Vienna Radio Orchestra under Laszlo Somogyi do very well.

★ ★ ★

BEETHOVEN. Sonatas for violin and piano. No. 3 in E flat major, op. 12 No 3. No. 4 in A minor, op 23. Fritz Kreisler and Franz Rupp. World Record Club. Connoisseur Series. CE/3025.

I am glad that this record has been issued, for too many of the present generation are inclined to think of Kreisler as a purveyor of what Sir Thomas Beecham called "Lolly-pops." In fact, he was one of the greatest violinists of his time and his only serious rival was Ysaye. Kreisler's performance of the classics, particularly the Brahms concerto, has never been excelled.

His extraordinarily noble character, which showed in his playing, was illustrated by his behaviour in America at the end of the 1914-1918 war. At the outbreak of war he was mobilised with the Austrian Army but was soon wounded and demobilised. He at once set out for the United States, having undertaken responsibility for the education of the orphans of his war com-

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tades. In spite of the situation caused by subsequent entry of the U.S. into the war, he gained the esteem and admiration of the American public and the concert, in which he reappeared at the Carnegie Hall in 1919, was a triumph.

Franz Rupp was born in Germany but has lived in America for many years. He and Kreisler were the first to record the complete set of Beethoven's violin and piano sonatas.

I personally do not consider the 10 violin and piano sonatas as among the most important of the composer's work. However, the first one has a lovely slow movement and the finale of the second one is a lengthy and most interesting movement. Kreisler plays the violin parts with lovely tone and, every now and again, a little nuance of tone is heard which only he could achieve.

Rupp plays the piano parts in a most satisfactory manner and the balance is excellent.

The transfer to the L.P. has been very well managed.

★ ★ ★

CARUSO IN SONG. 14 selections never before heard on L.P. R.C.A. Mono. Red Seal LM-2778.

The cover of this recording carries the interesting story that when Caruso secured his first engagement at the San Carlo in his native Naples, he was so poorly received and so badly criticised that he swore that he would never sing there again — and he kept his promise.

This record contains 14 items which have not been dubbed on L.P.s before and what has been said about previous dubbings remains true of this one. Apart from the surface noise, a common weakness of the old 78s was the poor quality of the accompaniments, whether piano or orchestra. In the attempt to curtail surface noise and to provide new accompaniments, those responsible nearly always succeed in removing the "animal" quality, which certainly existed in Caruso's voice, and made his singing so exciting, in spite of the bad taste he so often exhibited.

These recordings date from "Tosti's Ideale," 1906, to "I Remember Naples," 1920. The new accompaniments that have been put to the various songs are bad examples of this type of music.

One surprising inclusion is Tchaikowsky's "Pimpinella" which is well sung to a piano accompaniment. The record includes "Cujus Anima" from Rossini's "Stabat Mater," which is well sung, except for a disastrous attempt at a top D flat at the end.

The final item, "Ingemisco" from Verdi's Requiem, reveals what a wonderful voice the famous singer had and also what a help a properly written accompaniment is. The surface throughout is very good.

★ ★ ★

SIBELIUS. Violin Concerto in D minor, op. 47. Ginette Neveu. The Philharmonia Orchestra. Conductor: Walter Susskind. SUK. Four pieces, op. 17. Piano accompaniment by Jean Neveu. Connoisseur Series. World Record Club. C3/3026.

These two recordings are taken from the Homage to Ginette Neveu set, which was issued soon after her tragic death in 1949. The recording is satisfactory but lacks the depth and colour of a modern recording.

Writing some time prior to 1936, Donald Tovey remarked that the Sibelius Concerto would soon be bracketed with the Mendelssohn Concerto and the Bruch Concerto in G Minor as the three most attractive violin concertos ever written. This has not happened.

In the first place, the work contains traces of vulgarity which appear in all the composer's work and, secondly, it is a badly balanced work. The first movement is as long as the second and third movements and its musical content is on a much higher level. The second and third movements seem more like a happy addition to the number of small pieces the composer wrote.

Sibelius was a violinist himself and knew the capabilities of the instrument but he did not hesitate to write music to tax virtuosity. In saying this, however, it must be admitted the concertos of Bartok, Berg and Schonberg require an even higher development of the violinist's powers.

Ginette Neveu was always completely at home in this work and plays it with remarkable authority. The accompaniment is most satisfactory.

Joseph Suk was born in Prague in 1874. He studied composition with Dvorak and, at the age of 18, married his master's daughter; his wife died in 1905. The best of his work, including these four pieces, were written during his short but happy married life. The pieces show great imagination and harmonic freedom and both the violinist and her gifted brother play them in a most endearing fashion.

★ ★ ★

BUSONI. Indian Fantasy, op. 44. Bortkievich. Piano Concerto in B flat, op. 16. Marjorie Mitchell, piano. Vienna State Opera Orchestra. Conductor: William Strickland. Universal Record Club. Mono VC-692.

To the present generation, Ferruccio Busoni is mainly known as an expert editor of the works of Bach. He was born in Italy in 1866 but spent most of his childhood in Austria. He appeared in Vienna as an infant prodigy at the age of 9 and won great applause from Brahms.

There followed a series of most successful "prodigy" tours but, at 20, he began serious study in composition at Leipzig. After three years he was appointed to the Helsinki Conservatorium and then proceeded to teach the piano and composition in various parts of the world.

He composed a great deal of music but his skill as a teacher and a performer seems to have blunted his critical sense as a composer. His work is almost always dull and his sonatina on themes from Carmen is, to me, one of the silliest works I have ever listened to.

The Indian Fantasy was written in Berlin in 1913. Always lacking an ability to write tunes, he based it on North American Indian melodies and it is very much in the romantic Liszt tradition. The melodies are harmonised in the Stephen Foster tradition and, beyond allowing a certain display of virtuosity, the work has nothing much to commend it.

Marjorie Mitchell is an American pianist who can certainly meet any demands the work makes. The same applies to the orchestra and Strickland.

Serge Bortkievich was born in St. Petersburg in 1877. A gifted pianist he left Russia in 1904 to study in Berlin. He returned to Russia in 1914 but, after the Bolshevik revolution, settled in Turkey. This concerto is influenced strongly by Tschaikowsky but his lengthy stay in Berlin led to many other influences appearing in his work. The concerto has very little character and its only merit is as a show piece. Once again, the soloist and the orchestra are both quite satisfactory.

★ ★ ★

SHOSTAKOVITCH. Symphony No. 9, Op. 70. Prokofiev, Lieutenant Kije Suite, op. 60. London Symphony Orchestra. Conductor: Sir Malcolm Sargent. World Record Club. Mono. T/4008.

There always seems to be something eventful associated with a composer's ninth symphony. Ever since Beethoven's time, a composer seems to have felt he was defying the fates in attempting a ninth symphony. But Shostakovitch's fate with his ninth symphony was amusing rather than tragic.

After the strong and warlike seventh and eighth symphonies, the ninth proved to be jovial and relaxed. It was well received at its first performance in Leningrad in 1945 and equally enjoyed in America. For a year the work enjoyed a warm reception throughout Russia when suddenly an article appeared in "Culture and Life," an official publication of the Communist Party, sharply attacking both the symphony and its composer for their failure "to reflect the true spirit of the Soviet people."

In other parts of the world the work still enjoys popularity.

The symphony is in five movements, the last three played without a pause. The first movement in a classical "Allegro" which might reflect the spirit of Haydn. There follows a romantic "Moderato" and a precipitous Scherzo. The Largo is unusual for its long quasi-improvisational solo for the bassoon. In fact, throughout the work, the number of solos for wind is unusual.

Sir Malcolm Sargent and the orchestra give a very satisfactory reading except for the last movement, which is full of the composer's love of buffoonery. I thought this might have been emphasized a little more.

The Lieutenant Suite is taken from the music Prokofiev wrote for a moving picture of the same name. The story is based on the line that the Czar misreads the name of an officer who has been highly praised. To save embarrassment, the courtiers have to invent such an officer and make up stories about him. When the Czar finally asks to meet the officer, the latter has to be killed off.

There are five movements in the suite, The Birth of Kije, A Romance, Kije's Wedding, Troiks and Kije's Funeral. Of all the modern Russian composers Prokofiev has the strongest sense of humour and this, coupled with his skilful scoring and intriguing use of wrong notes, gives the work a most piquant air. It is cleverly and amusingly played by the orchestra and Sir Malcolm Sargent.

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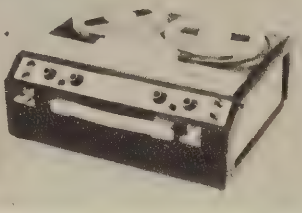

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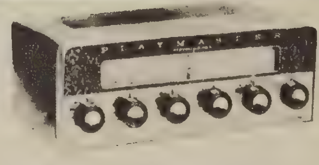

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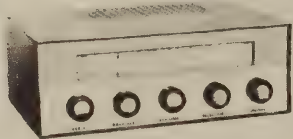

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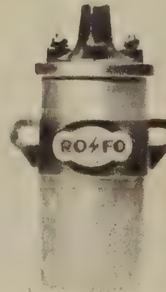

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DOCUMENTARY RECORDS

Reviewed by Ellis Blain

ORIES OF GUY DE MAUPASSANT read by NELSON OLMSTEAD. (Vanguard VRS 9128)

At one time or another everyone must ve been chilled by a de Maupassant iller. He is one of the undisputed sters of the short story but his range by no means limited and, on this one ord, containing but five of his many ndred tales, there is sufficient variety. illustrate the sympathetic, the meta- ysical, the ambiguous, the witty and donic as well as the merely exciting.

De Maupassant is an ideal author for ding aloud as the story line is always the essence. His was not the role of a cher, preacher, or philosopher; simp- that of a story-teller. The readings are ar and well paced if, perhaps, a little king in dramatic expression at times. t many will prefer this restraint. My ly criticism of the reader is that there a hint of a lisp which I cannot ascribe the recording quality, which is first- ss. Recommended.

* * *

RRY, WRONG NUMBER — Agnes Moorhead with supporting cast. Directed by William Spier. EDGAR ALLAN POE — "The "Telltale Heart," "Annabel Lee," "Silence." Festival FL-7180.

This local release of some time ago s brought to my attention by Barry eyton, of television fame, when I in- viewed him for a new A.B.C. series radio programs recently. Interesting- Barry's enthusiasm is for the poem Poe, "Annabel Lee," although he was racted originally by the sketch, orry, Wrong Number."

To take the poem first. Undoubted- this is one of the most moving oken word performances I have heard record. The speaker is James Mason d, incredibly when one comes to put it wn in black and white, he is sup- rted by a WURLITZER ORGAN. it the effect is neither cheap nor over amatic which is a tribute to the im- ccable taste of the organist, the late uddy Cole, and to the power d sincerity of Mason's reading. But e poem itself, which suggests rather an directly relates the tragedy which fell Poe when his young and lovely fe, Virginia, died in her early twen- s, is so ethereally beautiful with its hoing rhymes, wave-like rhythms and gnificantly sounding repetitions, that it ust stand as one of the supreme lyric eations in the English language.

"Silence" is treated in the same way, th organ accompaniment and, in its ay, is equally effective although it is prose poem of considerably greater ngth. But the magic of "Annabel ee" is not to be found in the theme hich is closer to the author's macabre les, despite the partly poetic form.

"Sorry, Wrong Number," as the name nplies, centres around the tele- one and the dramatic role it plays in ontemporary life. It is a first-rate story lendidly acted and produced — thriller with a contemporary setting.

TENNESSEE WILLIAMS READING FROM "The Glass Menagerie," "The Yellow Bird" and "Five Poems." Philips Caedmon TC-100.

How could this record be anything but a "must" for the innumerable disciples of Tennessee Williams?

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And they are all read exactly as they should be by probably the only man alive who could read such individual material quite so individually, the author himself.

Recording excellent.

* * *

OSCAR WILDE'S FAIRY TALES, read by Arthur Luce Klein and Frank Pettingell. Spoken Arts No. 785.

The fairy tales of Oscar Wilde are strictly individual material and often enough do not enchant even staunch admirers of the author. On the other hand, they may have a quite unexpected appeal for those who do not care for Wilde's other work.

Only two are contained on this recording, "The Happy Prince" and "The Remarkable Rocket." Arthur Luce Klein who, as a matter of interest, was the first American to be appointed to the directing staff of the Royal Academy Of Dramatic Art in London, reads the former and veteran actor-producer, Frank Pettingell, the latter.

If these distinctive period pieces appeal, you should enjoy the highly professional performances recorded here.

COMPUTERS — cont.

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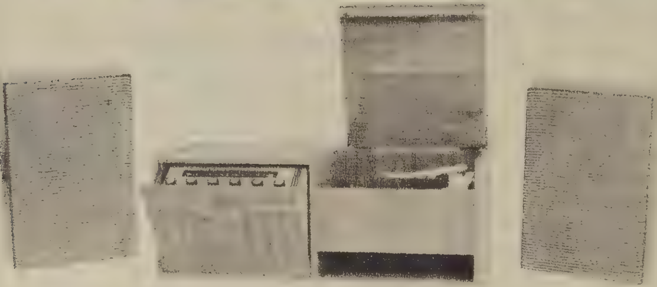

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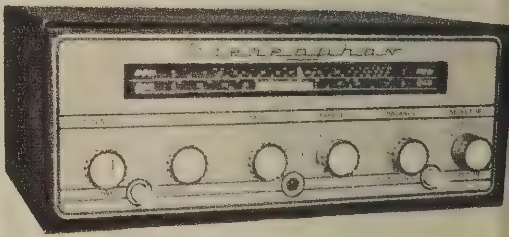

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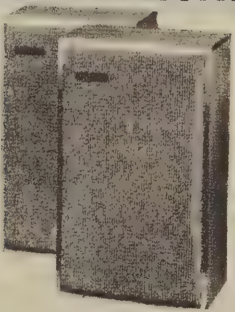

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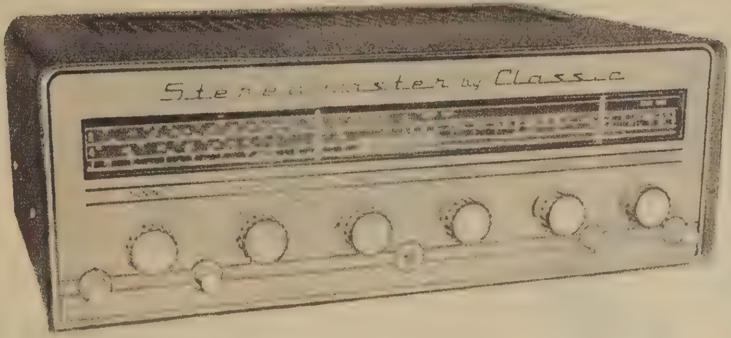

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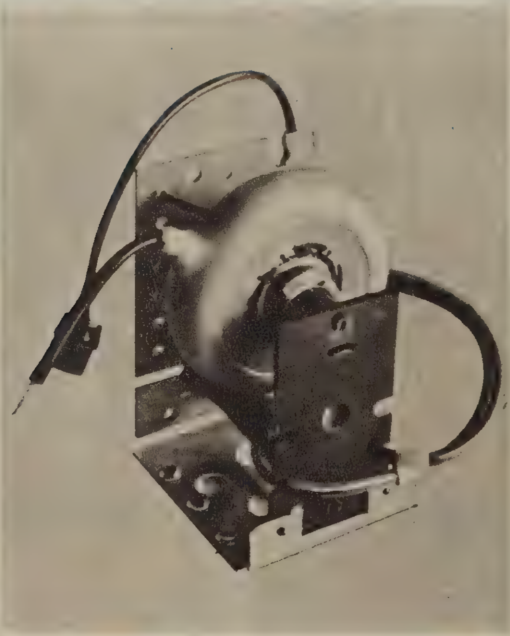

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Devotional

ORWARD TO CHRIST. Joseph Bellesi, Baritone, with Paul Mickelson Orchestra and Choir. Arranged by James Boersma. Stereo, Supreme SS-2007.

Interest: Male Gospel vocalist.
Performance: Very high standard.
Quality: Mostly good.
Stereo: Modest.

Last month I reviewed in rather glowg terms an album of duets by Helene andrum and Joseph Bellesi — "I've iscovered The Way." In this album oseph Bellesi sings alone, backed by e same orchestra and choir.

Born in Hollywood, son of a minister, e began to study singing at an early age, eading into a career which has included creen, stage, radio, television and sacred pera. He is currently soloist at the emple Baptist Church in Los Angeles.

As in the record previously reviewed, e training and experience shows here polish, in sensitivity and a fine sense f pitch, which does not falter through umbers which are variously formal nd difficult:

"I Asked the Lord," "Sun Of My oul," "Speak My Lord," "The Twenty-hird Psalm," "Fear Not O Child Of od," "There Is A Green Hill Far way," "But For The Grace Of God," No One Ever Cared For Me Like esus," "I Want Jesus To Walk With e," "God Leads Us Along," "Forward o Christ."

Through most of the tracks the sound good, though slight tracing distortion evident on the two innermost tracks. owever, this is a small point in a ecord which is otherwise so com- endable.

Recommended. (Southwell Supplies, 76 Geelong Rd, Footscray, W11, Vic.) W.N.W.)

★ ★ ★

IGH TIME YOU HEARD. Thurlow Spurr and The Spurrlows. Mono, Word (Gospel Film Ministry). W-3246-PL.

Interest: Gospel concert group.
Performance: First rate.
Quality: Good.

It so happened that, a couple of days efore reviewing this album, I saw the ligious film "Face The Music," in hich this group is featured. And a ery polished group it is.

In their own road-coach, they travel om city to city, featuring in concert alls, church auditoriums, High school ssemblies, radio and television stations -in fact anywhere they can promote or pport Gospel campaigns.

Judged on the film, their stage pre- ntation is of a high standard, while eir sound, on film and record alike, nderlines the capabilities of Thurlow purr both as arranger and conductor. short, this group of dedicated young people rates direct comparison with the professional singing groups on other labels.

They present here: "He Keeps Me Singing," "With A Song," "Now We Sing Joyfully," "Let's Go To Church," "First Place," "He's A Mighty Big God," "Balm In Gilead," "The Glory Road To Heaven," "Let Not Your Heart Be Troubled," "He's Got The Whole World In His Hands," "Young Heart," "Lead Me To Calvary," "In The Garden."

An excellent and varied Gospel program. (W.N.W.)

★ ★ ★

HE LEADETH ME. Pat Boone, with Brass, Choir and Chorus conducted by Jerry Fielding. Mono, Dot (Festival) ZL-31,504.

Interest: Favourite hymns.
Performance: Smooth.
Quality: Normal.

I reviewed this record, as a stereo release, on the E.M.I. London label in July 1960. On that occasion, I wasn't very enthusiastic, partly because Pat Boone's singing seemed rather negative and partly because of the general balance, which seemed to call for some "bass-up treble-down" treatment.

Though compounded from the same master tapes, this new mono version on the Dot label is a better proposition. The soloists' voice has been brought forward from the accompaniment and the whole thing is, to my ear, better balanced.

As I indicated in the earlier review, Pat Boone sings these old favourite hymns in a smooth, modest manner which will certainly please his fans, though others may wish for a little more fire:

"He Leadeth Me," "I am Thine O Lord," "Blessed Assurance," "Take The Name Of Jesus With You," "What A Friend We Have In Jesus," "Nearer My God To Thee," "Rock Of Ages," "Let The Lower Lights Be Burning," "I Love To Tell The Story," "God Will Take Care Of You," "Saviour Like A Shepherd Lead Us," "God Be With You Till We Meet Again."

A case where I like the "mono mix" better. (W.N.W.)

★ ★ ★

HYMNS, ORGAN AND CHIMES. Dr Norman Soreng Wright, organ; Dr Charles S. Kendall, chimes. Stereo, Dot SZL-931,534. (Also available in mono ZL-31-534.

Interest: Organ plus chimes.
Performance: Capable but not outstanding.
Stereo: Separates organ and chimes.
Quality: Lacks brightness, definition.

This is one that I think you had best hear for yourself, for it is a record that individuals could as easily like as dislike —and for the very same reasons!

The "like" reaction would be on the basis of a sombre organ playing "straight" well-known Gospel melodies, with chimes added for good measure.

The "dislike" reaction would be for an organ rendered sombre by a complete lack of treble response and for chimes that are uncomfortably off-pitch and off-beat—as chimes so frequently are.

The chimes are probably of the amplified variety, while the organ is probably an electronic that sounds like a pipe—although it could be the reverse; such is the "sombreness" of the organ sound.

The titles: "The Church In The Wildwood," "The Old Rugged Cross," "In The Garden," "Saviour, Like A Shepherd Lead Us," "Sweet Hour Of Prayer," "I Am Thine, O Lord," "Blest Be The Tie That Binds," "What A Friend We Have In Jesus," "Jesus Keep Me Near The Cross," "Jesus Calls Us," "I Need Thee Every Hour," "Softly And Tenderly," "I Love To Tell The Story."

As I remarked earlier, one you should hear for yourself. (W.N.W.)

★ ★ ★

WILMA FINALY, Vocal. "You Can Have A Song," "On The Jericho Road," "I'm Bound For the Kingdom," "Where The Roses Never Fade." Mono, 45EP, Sourec Gospel Recordings, PR-338.

Interest: Gospel songs.
Performance: Lacks polish.
Quality: Good.

Wilma Finlay, an Australian now resident in New Zealand, teamed with her husband Welburn, an accordionist, to present this bracket of Gospel songs. They sound a very happy couple and I have no doubt that, on stage, their general attitude would be infectious. Un-

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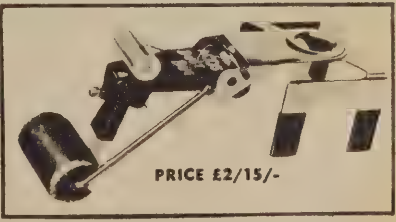

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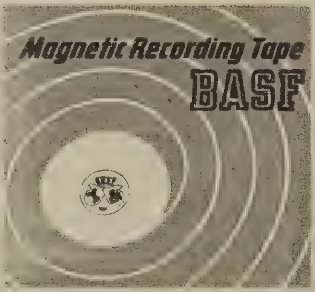

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ortunately, the atmosphere is compromised, as far as this disc is concerned, y an overall lack of smoothness and olish, the most obvious single failing eing loose diction.

In these days, when Gospel recordings re relatively plentiful and made to virtu-lly full professional standards, anything hort of these standards must suffer by omparison.

For those interested in a new Gospel ecording venture, the disc is produced y Sourec Gospel Recordings, c/- P.O. ox 487, Wellington, N.Z. In Australia, ourec Gospel Recordings of Australia, .O. Box 52, Malvern, Victoria. The rice is 12/6 Australian, and 10/6 in ew Zealand currency. (W.N.W.)

FROM STAGE AND SCREEN

ARMEN JONES. Arrangements by Bobby Richards, orchestra conducted by Kenneth Alwyn. Produced by Cyril Ornandel. World Light Music Club. 12-inch mono, LM 7041.
Interest: Bizet/Hammerstein.
Performance: Generally good.
Recording: Excellent.

The soloists in this recording of the ongs from **Carmen Jones** are Grace umbry (Carmen), George Webb (Joe), na Babb (Cindy Lou), Elizabeth Welch Frankie) and Thomas Baptiste (Husky). hey are supported by the chorus of he Michael Sammes Singers with Solo-sts Ursula Connors and Edward Dar-ing.

The performance is generally very ood, with good singing and strong sup-ort, but inevitably one is drawn to a omparison with the recording of the ilm sound track, with which most lovers f the work will be familiar. And to my nind the comparison leaves the present ecording at something of a disadvant-ge—particularly in terms of the solo-sts.

For although the singing on the pre-ent recording is good, that on the sound rack is better. Grace Bumbry as Car-nen tries hard but can't seem to attain he right feeling of the part; she uses o my mind too much vibrato, and sings oo self-consciously to convey a feeling f involvement. The later criticism eems to be applicable also to the other oloists, but to a lesser extent; slight laws in timing and intonation reveal a esser degree of involvement than was he case with Marilyn Horne, LeVern lutcherson and company.

In terms of songs covered, the present ecording is virtually identical with the ound track recording, and the technical uality of both recordings is equally igh. Thus a decision between the two vill depend mainly upon the reaction of he prospective buyer to the differences n performance by the solists. I can't elp feeling that they'll prefer the sound rack version. (J.R.)

* * *

IORE MUSIC FROM MILLION DOLLAR MOVIES. The Boston Pops Orchestra, conducted by Arthur Fiedler. Stereo, RCA Dynagroove LSC2782 (Also available in mono).
Interest: Movie themes.
Performance: Excellent orchestra.
Quality: First rate.
Stereo: Well spread.

There should be plenty of takers for this combination of a large, highly rated orchestra and suitably arranged movie themes. In fact, according to the jacket notes, this new album was inspired by the success of the original "Music From Million Dollar Movies" by the same orchestra and conductor.

In this new disc, the quality is excellent, the stereo is excellent and there's plenty of everything for those who like the sound of a symphonic style orchestra. The themes:

"More" (Mondo Cane), "Tom Jones," "Days Of Wine And Roses," "The Longest Day," "Stay With Me" (The Cardinal), "Charade," "Get Me To The Church On Time" (My Fair Lady), "Moon River" (Breakfast At Tiffany's), "Chim Chim Cheree" (Mary Poppins), "Anthony And Cleopatra Theme" (Cleopatra), "Whistle While You Work" (Snow White And The Seven Dwarfs), "Lawrence Of Arabia."

Listen particularly to the arrangement of "Whistle While You Work"; it would be an excellent illustration for young folk of how a simple and familiar theme can be arranged for orchestra. (W.N.W.)

* * *

THE ROBERT SHAW CHORALE AND ORCHESTRA ON BROADWAY. Conducted by Robert Shaw, Arranged by Robert Russell Bennet. Stereo, RCA Dynagroove LSC-2799 (Also available in mono).
Interest: Popular Broadway melodies.
Performance: Excellent.
Quality: Excellent.
Stereo: Good spread.

To me, mention of Robert Shaw Chorale conjures up an impression of the quieter, well-ordered kind of arrangement. These arrangements are well ordered—extremely so—but, apart from a couple of numbers, they are certainly not quiet!

I gained the impression that the 40-voice Chorale and the symphonic style orchestra thoroughly enjoyed playing these numbers — even as I enjoyed listening to them:

"Hello, Dolly," "Sunrise, Sunset," "Standing On The Corner," "Lost In The Stars," "There Is Nothin' Like A Dame," "Wouldn't It Be Loverly," "With A Little Bit Of Luck," "A Real Nice Clambake," "They Call The Wind Maria," "Seventy Six Trombones," "The Sound Of Music," "New York, New York."

Unless I miss my guess, this one should be very popular. It has what it takes! (W.N.W.)

* * *

NEW MOON, ROSE MARIE. Vocal Gems. Elizabeth Larner, Andy Cole, Tony Osborne and his orchestra. Mono, HMV Encore Series CELP 9110. (Also available in stereo).
Interest: Show evergreens.
Performance: Good.
Quality: Excellent.

H.M.V. offer this collection of favourite tunes from the two shows on their economy Encore label. Well presented and well recorded, it's a disc that makes very pleasant listening for a modest expenditure. The track titles:

Side 1, "NEW MOON": "Overture," "Marianne," "Softly As In A Morning Sunrise," "One Kiss," "Stout Hearted

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Dual 1009

Dual 1010 Record Changer

Permits following modes of operation: manual single record play; Automatic single record play with short spindle, and automatic record changing of up to 10 records of same size with changer spindle. Self-stabilising changer spindle (without overarm), modern lightweight tonearm of high torsion-resistance and small mass, with tonearm lock and separate muting switch, for both stereo channels. Cartridge holder with Dual stereo crystal cartridge CDS 620. Operation by means of two smooth working slide switches for record size selection. Start (and instant-change), instant stop (also returns tonearm to its rest), and manual operation. 4-speed, rugged 2-pole Dual induction motor, automatic disengagement of drive wheel.

STANDARD: £29/6/- **HI FI: £31/9/-**

Dual 1010

Dual 1011 Record Changer

Permits intermix of different size records, otherwise operation and features are as in Dual 1010: manual single play, fully automatic single play, full automatic changing. Operates with slide switch for start (and instant change), instant stop with automatic return of tonearm to its rest), and manual operation.

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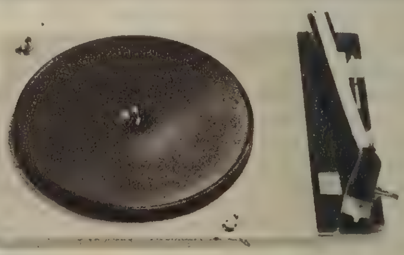

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Side 2, "ROSE MARIE": "Overture," "Rose Marie," "Pretty Things," "Song Of the Mounties," "Totem Tom Tom," "The Door Of My Dreams," "Indian Love Call," "Finale." (W.N.W.)

★ ★ ★

BITTER SWEET, Highlights. (Noel Coward). With Vanessa Lee, Roberto Cardinali, Julie Dawn, John Hauxvell, the Rita Williams Singers, Michael Collins and his Orchestra. Stereo, HMV Encore Series, SOELP 9137.

Interest: Popular musical.
Performance: Good.
Quality: Mostly good.
Stereo: Normal.

Ever since the middle thirties, when ts songs were played so frequently over he air, I've had a soft spot for the music from "Bitter Sweet." It was no chore, therefore, to listen to it again on his Encore series, economy release.

Vanessa Lee is over-generous with the vibrato for my personal taste and there s a trace of distortion on some of the peaks but the album is well worth adding to your collection if you have nostalgic memories of this most popular Noel Coward musical:

"Overture," "The Call Of Life," "If You Could Only Come To Me," "I'll See You Again," "Ladies Of The Town" "If Love Were All," "Dear Little Cafe," "Tokay," "Kiss Me," "Ziguener," "Finale." (W.N.W.).

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SPANISH MOOD—The Knightsbridge Singing Strings. "Amapola," "La Paloma," "The Breeze And I," "Frenesi," "Besame Mucho," "Granada," "Siboney," "Green Eyes," "Perfidia," "Amor." Festival, Stereo. SFL-931,704.

Interest: Soft mood music.
Performance: Smooth.
Quality: Very good.
Stereo: Emphasised separation.

This is another of those recordings eaturing smooth music of the background variety. There are no details, n the jacket notes, of the group performing but they play well, from good orchestrations which feature just enough muted trumpet, vibes, flutes, etc., to dd "colour" to the strings.

The audio quality is very good and he stereo effect quite pleasant, although with a tendency to "split" the orchestra or an emphasis on separation. A pleaant disc if you've the mood for some asy listening and favour the Spanish umbers featured. (K.W.J.)

★ ★ ★

FAMOUS TUNES FROM THE CLASSICS No. 2. Mono, HMV OCLP-1840.

Interest: As per the title.
Performances: Excellent.
Quality: Good.

According to the jacket, the 12 exracts presented here have been selected with special thought to their ultimate enoyment by young people. It is suggested, or example, that they are eminently uited for playing at Morning Assembly eriods at school.

I can well imagine that they would be well suited for school presentation but ppraisal of the record should not stop ere and I can recommend it to any listener who prefers the classics in small helpings. As such, this is a highly listenable album and, by way of guidance to the uninitiated, the background of each extract is given in the notes.

Without seeking to identify the tracks fully, the extracts are taken from: Handel—Concerto Grosso in B Minor; Mozart—Horn Concerto No. 1; Beethoven—Symphony No. 2; Schubert—Symphony No. 9; Gounod—Petite Symphonie; Elgar—Enigma Variations; Brahms—Serenade No. 1 in D; Haydn—Cello Concerto in D; Stamitz—Concert in D for Violin, Viola and Orchestra; Corelli—Concerto in F for Oboe and Strings; Bach—Suite No. 2 in B minor for Flute and Strings; Britten—Simple Symphony.

All are played by soloists, orchestras and conductors of world repute. (W.N.W.)

★ ★ ★

YOU DO SOMETHING TO ME. Victor Silvester and His Silver Strings play the music of Cole Porter. Columbia "Encore" 12-inch stereo, S330EX 9106. On mono, 330 EX 9106.

Interest: Dance music.
Performance: Famous style.
Recording: Fine.
Stereo Quality: The same.

A Columbia re-release on their Encore economy label, with Victor Silvester and his famous Silver Strings playing the music of Cole Porter. A fine disc for dancing, particularly for "squares."

The tunes played are "You Do Something to Me," "Just One of Those Things," "Love for Sale," "In The Still of the Night," "Rosalie," "Begin the Beguine," "I've Got My Eyes on You," "Allez-Vous en, Go Away," "Easy To love," "So In Love," "I Love You Samantha," "It's All Right With Me," "I Get A Kick out of You," "I've Got You Under My Skin," "After You" and "True Love."

The recording and stereo are both fine. (J.R.)

★ ★ ★

TRUMPET SHOWCASE — RAFAEL MENDEZ with Symphony Orchestra. "Around The World," "La Madre Del Cordero," "Encino Polka," "Ave Maria," "Figaro," "La Vie En Rose," "Anniversary Polka," "Patzcuaro," "The Lightning Trumpet." Festival, Stereo. SDL-931,710. (Also available in Mono.)

Interest: Virtuoso trumpet.
Performance: Masterful.
Quality: Excellent.
Stereo: Good spread.

In this disc we are treated to some more of Rafael Mendez' superb tone and technique on the trumpet — this time with a full symphony orchestra providing the backing. Although I still doubt the claim that this dazzling virtuoso is "the greatest trumpeter in the world today" (he has yet to show he can play jazz) I have no doubt that he is one of the greats and probably the best in his particular style.

His performance, on this disc, of "Figaro" from "The Barber Of Seville" is quite remarkable as is also his three trumpet, multiple recording of "Anniversary Polka," a Mendez original.

The audio quality of the disc is really first class and the stereo has a good, wide spread. The disc is highly recommended to those who like virtuoso trumpet with a lavish orchestral background. (K.W.J.)

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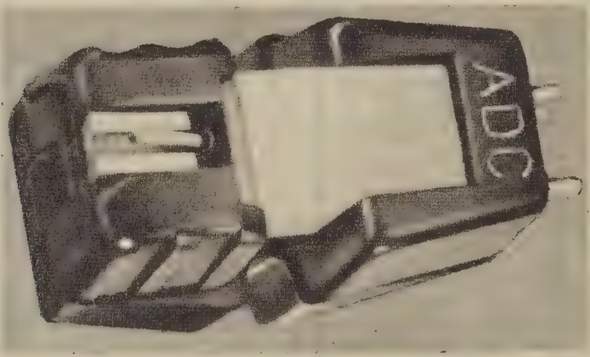

Excerpt from a report in the June, 1965 issue of the "Gramophone" (U.K.) on the last London Audio Fair held at the Hotel Russel.

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COMMAND'S NEW AND EXCITING PIANO CONCEPTION, with Lee Evans and his orchestra. Originated and produced by Enoch Light. Command 12-inch stereo, SNDL-931,638.

Interest: Pop/jazz piano.
Performance: Sparkling.
Recording: Excellent.
Stereo Quality: Smoothly spread.

I must confess myself somewhat puzzled by the extravagance of the title and sleeve notes of this disc; Lee Evans and his orchestra play some very interesting arrangements, and they play them in a sparkling and entertaining fashion, but at no stage of my initial listen to the disc was I moved to the degree which one might expect from the title and notes. I can only hope that other listeners will have a more favourable reaction —I imagine there's no better way to consign a "good average" performer to obscurity than to advertise him as "new," "exciting," "fabulous," a performer of "unbelievable virtuosity," and a creator of music "that has the intense driving immediacy of today and the vast soaring promise of tomorrow."

Perhaps it would have been fairer to Mr Evans and record buyers alike to have been a little more conservative with the title and notes. However, enough said . . .

The tunes presented on this disc are "Theme from 'Black Orpheus'", "The Bad and the Beautiful," "Never on Sunday," "It's a Lonesome Town," "The Father of Girls," "Recado Bossa Nova," "Just One Of Those Things," "Sentimental Journey," "It Don't Mean a Thing," "They Didn't Believe Me," "Ladybird," and "Top Hat, White Tie and Tails." And as I said before, the arrangements are interesting while the playing is sparkling; certainly a most entertaining performance.

The recording is of excellent quality, and the stereo is quite smoothly spread. (J.R.)

★ ★ ★

GUITAR . . . PARIS—Tony Mottola. Originated and produced by Enoch Light. Command 12-inch stereo, SNDL-931,637. Also in mono on NDL-31,637.

Interest: Romantic guitar.
Performance: Smooth.
Recording: Excellent.
Stereo Quality: Widespread.

Another record for Mottola fans, this time a collection of French tunes played in the familiar smooth but rhythmic Mottola fashion. A fine disc for parties, dances or pleasant listening at any time.

The tunes played are "Boulevard of Broken Dreams," "The Poor People of Paris," "April in Paris," "(All of a Sudden) My Heart Sings," "La Vie en Rose," "Under Paris Skies," "Michele," "Dominique," "Gigi," "C'est Si Bon," "Comme ci, Comme ca," and "Mimi."

The recording is excellent; it doesn't sound like material recorded on 35mm master film, but it's quite clean and sweet. The stereo is widespread and smooth. Recommended. (J.R.)

★ ★ ★

A TRUBUTE TO JESSE CRAWFORD. George Wright at the Wurlitzer Pipe Organ. Stereo, Dot SZL-931,666. (Also available in mono ZL-31,666.)

Interest: Popular pipe organ.
Performance: First rate.
Quality: Good except for slight rumble.
Stereo: Good separation.

In the jacket notes, George Wright

ays tribute to a great popular organist, ow deceased, his one-time guide and nentor. From old recordings, which have ever been re-issued, George Wright tudied the arrangements, the style and resentation of Jesse Crawford in his rime, translated it to script, then set bout the task of reproducing the num-ers as they would have sounded to hose who heard the actual performances.

How successful he has been in this elf-appointed task could be the subject f much discussion among those inter-sted in this field but, whatever the ver-ict, it's still an excellent album of pop-lar organ numbers, marked by George Vright's characteristic dexterity.

The organ used is not identified but, nless I miss my guess, it is George Vright's own excellent instrument, set p especially for recording.

The titles noticeably do not duplicate ny of those on the two-record album The Best of Jesse Crawford" released ome time ago by Festival. (See our pril, 1965, issue.) "I'm Confessin'," Pale Moon," "What Are You Waiting or Mary?" "So Beats My Heart For 'ou," "Moonlight On The River," "I ove To Hear You Singing," "High lat," "Hawaiian Sandman," "Tiptoe hrough The Tulips With Me," "How m I To Know," "The Perfect Song," nd "When The Organ Played At wilight."

Technically, the sound is clean, with xcellent use of the stereo facility, though races of low frequency rumble show up vith the bass boost advanced.

But it's a good one, nevertheless. W.N.W.)

* * *

HAT HONEY HORN SOUND—Al Hirt, trumpet, with chorus and orchestra. Produced by Chet. Atkins. RCA Dynagroove 12-inch stereo, LSP-3337. Also available in mono.

Interest: Pop trumpet.
Performance: Sparkling.
Recording: Excellent.
Stereo Quality: Smoothly spread.

For confirmed Al Hirt fans, or for hose who as yet haven't heard "the ing"—a dozen sparkling tunes. Arrang-d by Anita Kerr and Claus Ogerman nd played with delightful warmth and olish by Hirt and the orchestra, they nake fine listening. The disc would be splendid introduction to pop trumpet nusic, and would be fine for party istening.

The tunes are "Fancy Pants," "Danny oy," "Long Walk Home," "The Con-rary Waltz," "Fiddler on the Roof," None But The Lonely Heart," "Alley at," "Star Dust," "Butterball," "Over he Rainbow," "You Took Advantage of Ie," and "Flowers and Candy."

The recording is excellent; in the best Dynagroove tradition. A most enjoyable isc, and highly recommended. (J.R.)

* * *

DVENTURES IN FLAMENCO—Carlos Montoya. Ampar 12 - inch stereo, SML-931,624. Also in mono on ML-31-624.

Interest: Flamenco guitar.
Performance: Rhythmic, soothing.
Recording: Excellent.
Stereo Quality: Fine.

More "goodies" for flamenco lovers, his time a recording made by Carlos Montoya as something of an improvi-atory "tour de force." Recorded in only ne hour and forty minutes, as the sleeve otes tell us, the recording was made

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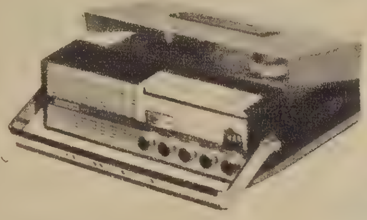

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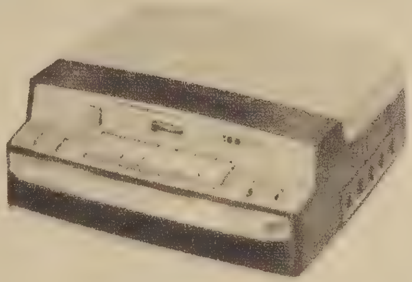

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with no rehearsals and with no formal repertoire planned; and every track was done in the one "take," with no repeats! Montoya and his instrument are certainly as one.

The tracks are called:

"Ritmos Gitanos," "Caribe Aflamencao," "Toque Murciano," "Recuerdos de la Sierra," "Albaicin Flamenco," "Compas Trianero," "Variaciones" and "Aires de Santa Maria."

The playing is flamenco and Montoya at their best; fiery and stirring with its rhythms, yet soothing with its subtlety and restraint.

The recording is of excellent quality. (J.R.)

* * *

THE LIMELITERS LONDON CONCERT, recorded in "live" performance at Festival Hall, London. "John Henry," "Zhankoye," "The Wabash Cannonball," "When I First Came To This Land," "The Hammer Song," "The Far Side Of The Hill," "Hard Ain't It Hard," "Lonesome Traveller," "The Little Burro," "Hey Li Lee Li Lee." RCA, Stereo. LSP-2907.

Interest: Folk Music.
Performance: Polished, entertaining.
Quality: Very good.
Stereo: Patchy.

Those readers who enjoyed the Limeliters' previous disc ("The Best Of The Limeliters," RCA LSP-2889) need have no fears about purchasing this new release; the performance on both discs are all but identical, the only difference being the actual numbers presented.

This will, incidentally, probably be one of the last discs to be released of the Limeliters as a group, since I understand that they have now gone their separate ways to appear as solo performers. This is a great pity because they were one of the wittiest, most versatile and entertaining groups to appear on the recent folk music revival scene.

The audio quality of the disc is a little below the best studio standards of today, but is very good for a "live" performance. The stereo effect is a little patchy due, apparently, to the performers' stage movements in relation to microphone positions. (K.W.J.)

* * *

A SONG AT TWILIGHT. The Roger Wagner Chorale. Produced by Ralph O'Connor. Stereo, World Record Club S-7095. (Also available in Mono.)

Interest: "Serene old songs."
Performance: Gentle.
Quality: Slightly noisy on side 2.
Stereo: Modest.

Remember the songs that Grandma used to sing . . . before the days of wireless?

You don't! Then this record probably isn't for you.

But you over there . . . you do! Well, here's your chance to come over all nostalgic. The songs certainly belong to Grandma's day, as also does the mood in which they are presented by the Roger Wagner Chorale:

"The Last Rose Of Summer," "Home, Sweet Home," "Love's Old Sweet Song," "Believe Me If All Those Endearing Young Charms," "When You And I Were Young, Maggie," "Goodnight, Ladies," "Bendemeer's Stream," "Flow Gently, Sweet Afton," "Drink To Me Only With Thine Eyes," "In The Gloaming," "Aloha Oe."

The quality generally is good, with modest stereo spread. My particular pressing showed some surface noise in the middle of side 2, though not enough to prejudice normal enjoyment of the music.

Incidentally, the jacket carries a reproduction of Renoir's painting "Lady At The Piano" and a card inside the jacket offers club members a 24in x 20in reproduction for 20/ plus 2/6 postage. (W.N.W.)

* * *

THE MIGHTY VOICE OF PAUL ROBESON, Bass. Mono, Encore Series, HMV OELP 9111.

Interest: Famous bass.
Performance: Classic Robeson.
Quality: Restricted frequency range but clean.

Characteristic of the Encore economy Series, there are no jacket notes to identify or date these performances but, judged on style and sound, they date back a fair way. Many may value the disc on these very grounds for, despite the technical limitations, it is a vivid reminder of the songs and the performances which made Paul Robeson famous:

"The Song Of Freedom," "The Black Emperor," "Sleepy River," "Lonely Road," "Deep River," "Summertime," "A Woman Is A Sometime Thing," "It Ain't Necessarily So," "It Takes A Long Pull To Get There," "Land Of My Fathers."

Despite the age of the original recordings, HMV engineers have done a commendable job in transcribing them. Some have doubtless been reprocessed from the original metal mothers, while in others, presumably from film or shellac recordings, the noise level has been filtered right down without too much damage to the famous bass voice.

Well worth a hearing by anyone with a soft spot for Robeson. (W.N.W.)

* * *

ODETTA SINGS DYLAN. "Baby, I'm In The Mood For You," "Long Ago, Far Away," "Don't Think Twice, It's All Right," "Tomorrow Is A Long Time," "Masters Of War," "Walkin' Down The Line," "The Times They Are A Changin," "With God On Our Side," "Long Time Gone," "Mr Tambourine Man." RCA "Dynagroove," Mono. LPM-3324 (Also available in Stereo).

Interest: Odetta.
Performance: Her best yet.
Quality: Excellent.

This new recording of Odetta singing a group of numbers composed by Bob Dylan is just about the finest piece of folk music I have heard in quite a long time. Bob Dylan's lyrics are often powerfully satirical and, it seems to me, they really need a vocalist with the emotional maturity of Odetta to do them full justice. I feel that Odetta's rendition of Dylan's numbers is much more interesting than Dylan's rendition of his own numbers.

The only criticism I might have concerns the obvious omission of certain verses from some of the numbers, particularly 3 prominent verses from "With God On Our Side." The silly part about this is that the missing verses are given, in full, in the jacket notes of the disc.

I fully realise that, in some circumstances, Dylan's lyrics might offend but surely if they're good enough to print then they could just as easily be sung.

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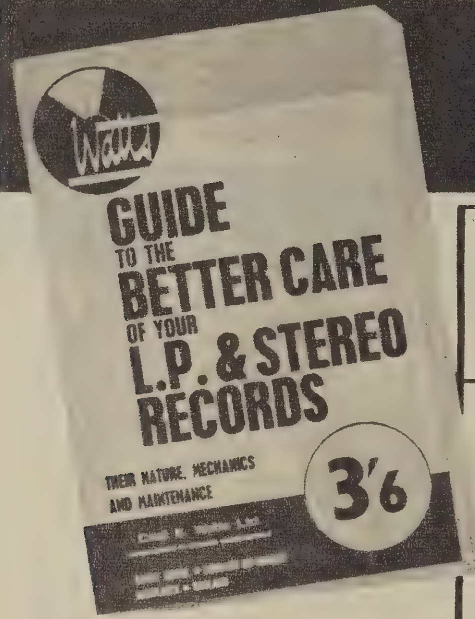

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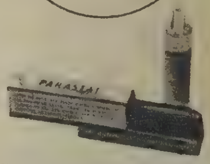

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The audio quality of the disc is first rate and no fears need be held on this score. (K.W.J.).

* * *

MAKEBA SINGS! Miriam Makeba with orchestra conducted by Hugh Masekela. "Cameroon," "Woza," "Little Bird," "Chove-Chuva," "Same Moon," "Kilimanjaro," "Whawayuani-Khanyange," "Wind Song," "Khuluma," "Let's Prtend," "Beau Chevalier," "Maduna." RCA Dynagroove Stereo LSP-3321.

Interest: African folk music.
Performance: Excellent but . . .
Quality: Excellent.
Stereo: Even spread.

The fact that Miriam Makeba can continue to record, and sell, numbers sung in a tongue foreign to the vast majority of her listeners is, I feel, a wonderful tribute to her remarkable vocal abilities. I wonder, however, how many people would, like myself, enjoy her singing just that much more if they could only understand what she is singing about. A vocal is, after all, an attempt to communicate with an audience via both words and music.

In spite of the foregoing and in spite of the fact that Miss Makeba was rather shabbily received, when in this country, there are, I feel sure, many people who enjoy her talents and these will find much to please them on this new release. The accompaniment on this disc is particularly fine and superior to previous releases.

The audio quality is also excellent and the stereo gives a nice spread to the orchestra with Miss Makeba at centre stage. (K.W.J.).

* * *

A LITTLE BIT OF HEAVEN. John Gary, with orchestra arranged and conducted by Marty Gold. Stereo, RCA Dynagroove LSP-2294 (also available in mono).

Interest: Irish Songs.
Performance: Capable.
Quality: High level but okay.
Stereo: Modest.

Here's another excellent record by popular young vocalist John Gary, in a "straight" presentation of traditional Irish melodies. Or should I say almost straight? John Gary has a vocal range of three octaves and a discerning sense of pitch and he is at some pains in the arrangements to make sure that you notice. But let's face it, he's good—and so is Marty Gold's backing.

The titles: "A Little Bit Of Heaven," "I'll Take You Home Again, Kathleen," "How Are Things In Glocca Morra," "Macushla," "Kathleen Mavourneen," "That's An Irish Lullaby," "Cockles And Mussels," "My Wild Irish Rose," "Galway Bay," "Mother Machree," "Believe Me If All Those Endearing Young Charms" and "When Irish Eyes Are Smiling."

One you'll like. (W.N.W.)

* * *

THE OLD REFRAIN. GRACE MOORE. Mono, RCA Gold Standard Series, 45EP, 20,336.

Interest: Once popular soprano.
Performance: Good.
Quality: Acceptable.

Listening to this re-recording of Grace Moore, it is not hard to understand her one-time popularity. Though the recording and the accompaniment sound as dated as they are, Grace Moore's voice is rich and true—except for the big note at the end of "Ciribiribin" that goes horribly astray. The other numbers are "The Old Refrain," "You Are Love," and "I Give My Heart."

Strong on nostalgia. (W.N.W.)

* * *

THE SENTIMENT AND HUMOUR OF BANJO PATERSON As read by Robert (Tex) Morton. Mono, Festival, FL31,696.

Interest: Australian poet.
Performance: Good.
Quality: Good.

Most people who attended Australian schools will have picked up a degree of familiarity with the poems of Banjo Paterson and their mixture of bush humour, bush sentiment and general "Australiana."

A representative group is presented here by Tex (call me Robert again) Morton in a workmanlike fashion. If this statement has a hint of reservation, it is because I couldn't help but feel that the readings lacked the vital spark of interest that has characterised earlier readings by the same artist. There is also a subtle difference between the voice and acoustic ambient in adjacent tracks, sufficient to imply some lack of continuity.

However, on the credit side, Tex Morton has a rich voice, far more pleasant to the ear than is common with exponents of Australiana and, if you have any kind of a partiality towards Banjo Paterson, this reading is well worth a hearing.

The poems, some 15 in all, include "Saltbush Bill, J.P.," "The Road To Old Man's Town," "Mulga Bill's Bicycle," "On Kiley's Run," "Been There Before," "How Gilbert Died," "Santa Claus In the Bush" and the old favourite "The Travelling Post Office." (W.N.W.)

* * *

WE GET REQUESTS — THE OSCAR PETERSON TRIO. "Quiet Nights Of Quiet Stars," "The Days Of Wine And Roses," "My One And Only Love," "People," "Have You Met Miss Jones," "You Look Good To Me," "The Girl From Ipanema," "D & E," "Time And Again," "Goodbye J.D." Verve, Stereo. V6-8606.

Interest: Jazz piano.
Performance: Typically good.
Quality: Excellent.
Quality: Excellent.
Stereo: Good spread.

In this latest disc the Oscar Peterson trio demonstrates, once again, the reason why they are consistently at the top of polls taken among both musicians and the general public. The album is a tasteful mixture of current pop tunes, standards and originals, all given the "Peterson treatment" of above average melodic development and solid rhythmic blending.

Peterson has the happy knack of being able to please the public while at the same time giving full play to his virtuosity and technique. This is something which many of his contemporaries —who can only please a limited jazz audience—could take a lesson from.

The audio quality of the disc is quite excellent and the stereo has a good, even spread. If any criticism is warranted it might be about the balance. Peterson's piano is occasionally overshadowed by Ray Brown's bass which is, in my opinion, just a little too much to the fore. (K.W.J.).

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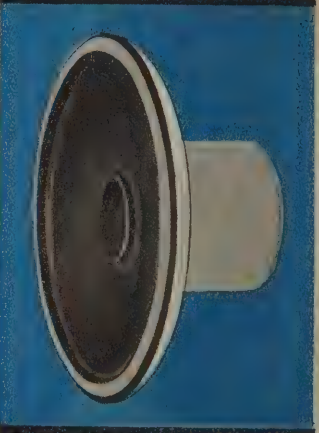
RESPONSE: 300-4,000
VOICE COIL IMPEDANCE: 8 ohm
POWER HANDLING ABILITY (PEAK) 250 mw
TOTAL GAP FLUX: 9,000
AIR GAP FLUX DENSITY: 6,000
BAFFLE OPENING: 2" round
MAXIMUM DEPTH: 1"



TYPE 225JB
RESONANCE: 350 cycles
RESPONSE: 300-4,000
VOICE COIL IMPEDANCE: 8 ohm
POWER HANDLING ABILITY (PEAK) [illegible] mw
TOTAL GAP FLUX: 10,000
AIR GAP FLUX DENSITY 7,000
BAFFLE OPENING: 2" round
MAXIMUM DEPTH: 1"

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SYDNEY: Electronic Parts Pty. Ltd. 560 7566 and all recognised wholesalers. **MELBOURNE:** Amalgamated Wireless (Australasia) Limited. 67 9161. Radio Parts Pty. Ltd. 30 1251. **ADELAIDE:** Newton McLaren Ltd. 51 0111: **BRISBANE:** Chandlers Pty. Ltd. 31 0341. **PERTH:** Amalgamated Wireless (Australasia) Ltd. 28 3426. **HOBART:** Amalgamated Wireless (Australasia) Ltd. 3 3836. **LAUNCESTON:** Amalgamated Wireless (Australasia) Ltd. 2 1804.

TRADE REVIEWS AND RELEASES

AKAI 1700 TAPE RECORDER

Magnecord Australia Pty. Ltd. announce the release of the new model 1700 recorder manufactured by AKAI Electric Co. Ltd., of Tokyo, Japan. The model 1700 is a 4-track stereo-mono machine intended to meet the demands of the low to medium-price field.

OUR photograph of the new recorder shows its attractive and quite professional general appearance. The instrument reviewed was housed in a dark grey, vinyl covered wooden case with a brushed aluminium front panel and neat black lettering. Attractive dark grey over-panels surround the left and right channel volume/tone controls and the VU meter. The play/record/forward/rewind knobs are of diecast metal, treated to match the front panel; a bright red safety record button is provided.

The model 1700 operates in either the horizontal or vertical position and its controls are clearly labelled and conveniently positioned for ease of operation. The machine has a single, combined playback/record head plus a separate erase head and each of these is adjustable for azimuth angle.

A single, 2-speed dynamically balanced induction motor drives the heavy flywheel-equipped capstan and, through a series of belts and clutches, the feed and take-up spindles. The machine's three speeds are achieved by the appropriate selection of motor speed and capstan size, the latter being equipped with a detachable bushing.

The circuitry of the recorder is simplicity itself, there being only four valves used in all. On playback each channel uses a 12AT7 twin triode feeding a 6BM8 single-ended output stage while, for recording, an ingenious switching arrangement changes the first half of each 12AT7 over to a push-pull bias oscillator.

Separate microphone and radio input jacks are provided but there are no mixing facilities, both connecting to a common grid and volume control, with the radio input injected through a resistive divider network.

Preamplifier output, external speaker (8 ohms impedance) and stereo headphone jacks are provided.

A switch on the right of the single VU meter changes this instrument from the left to the right channel, while the switch on the left of the meter selects either stereo or monaural recording/playback.

The machine is also equipped with an automatic stop mechanism, tape "pause" control, digital tape counter, safety lock "record" button and a speaker "mute" switch which cuts out the internal and external speakers and puts a "dummy load" on the output transformer.

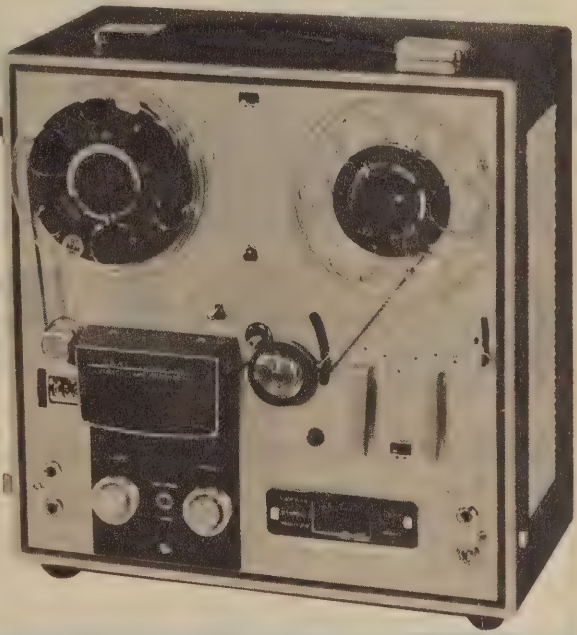
Manufacturer's specifications on the machine are as follows: Frequency Response—plus or minus 3db 80 to 12,000 cps at 7½ ips, 80 to 10,000 cps at 3¾ ips and 80 to 4,000 cps at 1⅞ ips; Wow and Flutter — less than 0.18% at 7½ ips, 0.25% rms at 3¾ ips and 0.30% rms at 1⅞ ips; Distortion — within 2% at 1,000 cps VU, total harmonic distortion; Maximum reel size — 7 inches; Power output — 3 watts at maximum on each channel (6 watts total), 1.5 watts undistorted; Fast Forward and Rewind Time — 2½ minutes for either operation using a standard 1,200-foot tape; Dimensions — 13½ by 13½ by 9 inches; Weight — 33lb without accessories.

In our laboratory tests the recorder proved pleasant and easy enough to use, the omission of head pressure pads making tape threading particularly easy. We found the recorder would meet all of its specifications, although the quoted frequency response could only be met if output was taken directly from the preamp and bypassing the output stages, the latter being somewhat lacking in bass response.

Correct compensation for the lowest speed is achieved with the tone controls advanced fully clockwise. The controls, which are of the simple "treble cut" variety, must be turned to about their mid position to achieve proper playback compensation on the higher speed ranges. Lack of a frequency compensating system interlocked with the speed change is one of the economies of the design.

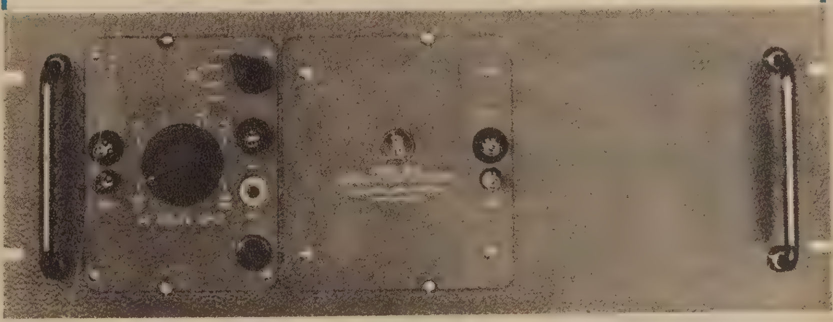
The recorder is normally supplied with a pair of good quality dynamic microphones plus accessory cords in a handy, zippered plastic bag at the list price of 129 gns. Optional accessories include an endless tape magazine, telephone pickup, tape splicer, monitor earphone, head demagnetiser, bulk tape eraser, stereo headphones and a range of stereo extension speaker systems.

Further enquiries on the unit should be directed to Magnecord Australia Pty. Ltd. of 158 Clarence Street, Sydney. (KWJ)



The AKAI 1700 Tape Recorder with brushed aluminium front panel highlighted in black.

Ballantine AC to DC converter



BALLANTINE Laboratories, Boonton, N.J., recently announced a new linear AC to DC Converter, Model 710A, for use in making accurate AC voltage measurements on any DC digital voltmeter, and for applications to a DC recorder, or to a Type K potentiometric system. The Model 710A, illustrated above, converts an AC voltage from 1 millivolt to 1,000 volts in decade steps at frequencies from 30cps to 250KC. Its accuracy of conversion is better than .25% from 1mV to 250V at midband frequencies of 50cps to 10KC. Other outstanding characteristics are as follows:

(1) DC output for each decade of AC input is 1,000 to 10,000 volts, thus making full use of a four digit DC voltmeter.

(2) A maximum sensitivity of 10 millivolts full scale AC for 10 volts DC output.

The above information was supplied by the Australian representative, Warburton Franki Limited, 307 Kent Street, Sydney. Further information may be obtained from this company in Queensland, Victoria and South Australia; from the Tough Instrument Service Company in Western Australia and from Associated Agencies Pty. Ltd., Hobart and Launceston.

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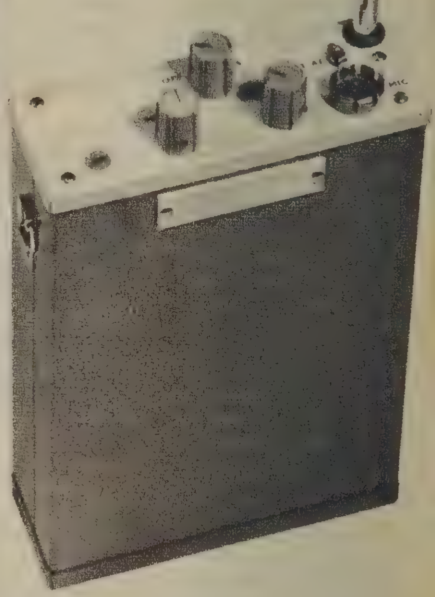
PORTABLE VHF RADIOTELEPHONE

Pye Pty. Ltd. recently released in Australia the Pye Bantam VHF Radiotelephone. Designed for personal communication with existing radiotelephone networks, this unit is extremly portable and very simple to use.

THE front panel of the unit features a maximum of four controls. These are a volume control, a fully noise-compensated squelch control, a function switch and, where multi-channel operation is required, a channel switch. A telescopic antenna fits well down in the panel when not in use while provision is made to plug in an external antenna for use in difficult locations, or for operation of the unit as part of a vehicular installation.



The function switch is used to switch the unit on. It also provides the selection of the in-built speaker or, for personal listening, switches the output of the receiver to the dynamic microphone insert.

The Pye Bantam can be supplied for any frequency between 27 and 174MC and is available to suit frequency modulation and amplitude modulation systems. The crystal filter incorporated in each unit allows it to meet the Australian 30KC channel spacing requirements.

Battery supply for this fully transistorised equipment can consist of standard torch cells, mercury cells, or a nickel cadmium storage battery. A special charger is also available for charging the nickel cadmium battery. Unless otherwise requested, the slide-in battery cassette is normally supplied to suit the standard penlite torch cells.

The unit is constructed around a fibreglass printed wiring board with a dip-coated finish. There is some crowding of components which is unavoidable in such a compact design and sometimes necessary at the frequencies involved. However, the service-man has not been forgotten, as all tuning adjustments are readily accessible.

Performance of the Pye Bantam both in reception and transmission was found to be excellent with the model submitted for review. Further details of this equipment may be obtained by applying to Pye Pty Ltd., or agents, in any capital city of Australia.

REPLACEMENT CARTRIDGES

BSR (A'asia) Pty. Limited now have available a wide range of monaural and stereo crystal and ceramic cartridges designed for replacement of most types fitted to record players in the low to medium-price field. The cartridges, illustrated below, are all new designs, the mono units superseding the previous TC8 range and with even better specifications.

THE three mono cartridges available are the X1M, X1H and X1HE. The X1M is a medium output unit (400mV) with a frequency response of 40cps to 10KC (plus or minus 3dB) and the reasonable compliance figure of 2.5 times 10 to the minus 6cm/dyne at a tracking weight of 4 to 6 grammes. The X1H is a high (800mV) output cartridge with a more limited frequency response at 40cps to 8KC, dynamic compliance of 1.3 times 10 to the minus 6cm/dyne and a recommended tracking weight of 7 to 10 grammes. The X1HE is an extra high output mono cartridge intended for the cheaper range of record players. No figures are to hand on this unit.

The SX1M is a medium output (250mV) crystal stereo cartridge with a frequency response (plus or minus 3dB) of 40cps to 10KC and a channel separation better than 14dB at 1KC. The dynamic compliance of this unit is 1.4 times 10 to the minus 6cm/dyne and recommended tracking weight is 5 to 7 grammes.

The SX1H is the high output version of the SX1M (750mV). It has the same channel separation characteristics but pays for its high output with a reduced frequency response of 40cps to 6KC and a much lower dynamic compliance of 0.65 times 10 to the minus 6cm/dyne. Tracking weight is also higher at 6 to 8 grammes.

In viewing the figures on the five cartridges listed so far it should be remembered that they are intended for the low to medium price record player or radiogram market and that, as such, they compare most favourably with contemporary units of equivalent cost.

For those who want something of better quality, but still at a most reasonable price, there is the type C1 ceramic stereo cartridge shown at the bottom right of our photograph.

This cartridge has a most respectable output of 100mV from the standard Decca SXL2057 test record and a dynamic compliance of 5.2 times 10 to the minus 6 cm/dyne. The unit's frequency response is 30cps to 12KC, plus or minus 3dB, and recommended tracking weight is 2 to 6 grammes. Channel separation at 1KC is a healthy 20dB and at 10KC there is still 15dB between channels.

In actual listening tests through a high quality amplifier and our "Playmaster Bookshelf" loudspeakers, the cartridge gave a good account of itself, approaching the Decca "Deram" cartridge, which sells for approximately twice the price.

In addition to the cartridges listed, BSR also have access to a pair of extra high output crystal stereo units which may be of interest to manufacturers.

Leaflets giving full details on all of the cartridges listed are available on application to BSR (A/asia.) Pty. Limited, P.O. Box 61, St Marys, N.S.W.

TRADE NEWS . . . in brief

R. H. CUNNINGHAM PTY. LTD. announce the release of the KW-600, a grounded-grid linear amplifier designed for use in the 10 to 80-metre amateur bands. The unit is manufactured by the well-known K. W. Electronics Ltd., of Kent, England.

The KW-600 employs a 572B triode valve amplifier in its straight grounded-grid circuit and incorporates internal power supplies. The main HT is approximately 2,000 volts, which can run the PA at over 500 watts input on CW and SSB. An inbuilt switch reduces the power input to 150 watts for tune-up or reduced power operation.

The amplifier uses a pi-coupler type output circuit designed to match low impedance (co-axial fed) antennas, an antenna changeover relay being incorporated. The driving power required by the amplifier is 20 watts, this being additive to the output power.

The unit is housed in an attractive metal cabinet measuring 13½ by 6 by 12 1/8 inches and, in addition to the usual front panel controls, there is a meter which reads RF volts, Linearity and Anode Current; a set of lamps indicate "Mains On" plus "High" and "Low" power operation. The PA is completely double screened for TVI proofing and a small blower is used to cool the output valve.

Any further inquires on technical specifications or price of the unit should be directed to R. H. Cunningham Pty. Ltd., of 8 Bromham Place, Richmond, Victoria.

AMALGAMATED WIRELESS (AUSTRALASIA) LTD. announce the release of DATABLOCs, a standardised range of diode-transistor logic circuits in miniaturised encapsulated module form. The standard range of DATABLOCs include: Clocked NOR Gate, Series Fed Driver, Pair of Series Fed Drivers, 2-Circuit NAND Gate paired with 2-Input NOR Gate, Pair of 2-Input NOR Gates, 5-Input NOR Gate, Pulser—Delay/Trigger.

Further inquiries to A.W.A.'s Teleprinter and Data Systems Group, 47 York Street, Sydney, N.S.W.

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SQUARE WAVE RESPONSE

A Correction and Apology . . .

A further letter has been received from Audio Dynamics Corporation, U.S.A., with reference to our April, 1965, advertisement. It reads as follows: Gentlemen:

It has been brought to our attention, that an advertisement was inserted in the April edition of the Australian magazine **Electronics** which incorporated an excerpt from an intra-company letter, the reproduction of which was both unauthorised by and unknown to us.

Unfortunately, this letter contained a mis-statement of fact, of which we were unaware, when the letter was written and which has caused considerable offence to Mr. Percy Wilson and Mr. Geoffrey Horn of the **Gramophone** magazine.

Contrary to what was stated in the letter, the cartridge tested for square-wave response was **not** the same unit as that taken by Mr. Wilson from our factory last year.

All other statements contained in the letter are accurate, however.

Audio Dynamics Corporation sincerely regrets the publication of this misinformation and offers its apologies to both gentlemen, as well as to the **Gramophone.**

The writer personally regrets any reflection on the integrity of either Mr. Wilson or Mr. Horn, however unintentional, as he holds both gentlemen in the highest regard.

Yours sincerely,
AUDIO DYNAMICS CORPORATION.
Peter E. Pritchard,
President.

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Exclusive Australian Representatives for ADC, U.S.A. and makers of the J.H. p.u. arm and synchronous turntable.

THE AMALGAMATED WIRELESS VALVE CO. PTY. LTD. announce the release of three plug-in, direct replacement silicon rectifier units. The units are designed to replace the valve rectifier types 8008, 872, 872A, 866, 866A, and 3B28.

FERRIS BROS. PTY. LTD., wish to announce that their Chief Industrial Designer — Mr Knaap — has been elected president of The Society of Industrial Designers of Australia. Mr Knaap is a foundation member of the S.I.D.A. and was instrumental in the establishment of a previous designers' association, the S.D.I., in 1952.

THE ANODEON SALES DIVISION of Electronics Industries Ltd., announce the release of Hitachi Silicon Field Effect Transistors types 3SK111, 112 and 113. Sample quantities of these transistors are now available ex stock and production quantities are available approximately 3 to 4 weeks from date of order. Prices and further details, including data sheets, are available on application to Anodeon.

FERRIS BROS PTY. LTD. announce the release of a new 4-piece, telescopic car aerial unit. The new aerial is constructed from chrome plated streamlined brass sections and has a universal base mounting designed to be body mounted on all modern vehicles. The aerial measures 18in long, retracted, and has an extended length of 4ft 6in. The aerial is supplied, as standard, with a 4ft 3in length of low capacitance coaxial cable terminated with a miniature bayonet plug.

HAWKER de HAVILLAND AUSTRALIA PTY. LTD. announce the appointment of Mr F. W. J. Orr, B.E.E., A.F.T.C., F.I.R.E.E., as Senior Eelectronics Manager. Mr Orr will co-ordinate the sales and servicing functions of this fast developing sector of the company's activity. Educated in Melbourne, Mr Orr joins the company from Philips Electrical, where he was Chief Technical Commercial Officer (Apparatus) for over six years.

LOUDSPEAKER AUTO-TRANSFORMER

FERGUSON TRANSFORMERS PTY. LTD. announce the release of this high quality speaker matching auto-transformer, type MT 456. Rated at 15 watts RMS, it has a total winding suitable for connection into 15-ohm circuitry, and taps corresponding to nominal impedances of 8, 3.75 and 2 ohms. Thus it will match 15-ohm speakers to amplifiers requiring 8-ohm loads, 8-ohm speakers to amplifiers requiring 15-ohm loads, and so on.

The total winding inductance is quoted as 6.7H at 10V and 50 cps; and tested in our laboratory the frequency response proved excellent except when using the 2-ohm tap; here the treble is a little down, as might be expected. Insertion loss is less than 1.5dB at 15 watt and 1KC, which is quite acceptable. Thus the unit would be a good choice where speakers of the "wrong" impedance must be matched to amplifiers or other equipment.

Price of the MT456 is quoted as 37/ trade, plus tax. Enquiries may be made via the trade houses. (Ferguson Transformers Pty. Ltd., 331 High St, Chatswood, N.S.W.

AMATEUR BAND NEWS AND NOTES

40 Years Ago — A Glimpse of History

Just as the history of Nations and of the Arts add to our knowledge and our appreciation of the progress civilisation has made, so does literature of forty years ago help us to appreciate the amazing progress that has been made in radio and electronics.

By Pierce Healy, VK2APQ*

IT is not often that one gets the opportunity or the time to peruse old magazines which detailed the popular ideas and trends of this science; a science which is today so commonplace that little or no attempt appears to have been made to preserve its history.

We were recently given a copy of the American publication "Radio News," edited by Hugo Gernsback, dated February, 1925, with the comment that it might be of some interest.

The contents proved to be most interesting, and gave some indications of the thoughts and the problems of those associated with radio more than 40 years ago, as well as an insight to the birth of some of the techniques and components which today are commonplace.

The "Editorial," titled "Radio Evolution," comments on several facits of the problems then being encountered and forecasts of possible future trends.

For the benefit of the younger generation who may not have had the opportunity to read the comments recorded so long ago, it was decided to quote some of the points made. And not forgetting the older readers, for whom it may recall cherished memories.

"Radio, like the whole of the universe, shares in the universal evolution. Radio has grown from infinitesimal beginnings into a huge art. If someone had the time and money to assemble a radio museum, a profitable afternoon might be spent in walking through and looking at such an interesting collection of radio apparatus.

"We would smile, and perhaps laugh at the original model coherer or the primal tuning coil, or the first sending and receiving sets. Just so, the imaginary visitor who visited this radio museum twenty-five years from now would smile at our present efforts, if he did not laugh out loud.

"For such is the way of evolution. All the while we are bringing out new things, learning new ways about our friends, the radio waves, and we are hopeful of learning more of their nature. The writer says "Hopeful" because it does not appear that we shall ever know much about them.

"The coming year, for instance, will probably go down in radio history as the Low Loss Year. We have suddenly found out, it would appear, that our former good old condensers and our former aristocratic tuning inductances are all wrong.

"The reason for this is that a few nights spent in our laboratories have shown us that radio frequency currents behave in an outrageous manner as compared to their brothers audio or low frequency currents. We also find that what we formerly thought were excellent insulators act almost as badly as metals when we try to use them in radio instruments. For that reason we now have the present Low Loss era. Instead of using bakelite, cardboard, or hard rubber tubing for our inductances, our engineers prefer to use air—and no tubes at all—because air just now is just the best insulator.

"Our fixed condensers have as yet not been touched by the low loss fever, although they are the worst offenders in this respect. Nearly all fixed condensers, whether mica insulated or otherwise, have fearful losses in the eyes of the engineer, and it is safe to say that we will have a revolution in fixed condensers.

"Vacuum tube sockets also have large losses, which will probably soon be remedied, our leading manufacturers already have helped the movement by providing composition bases which are now incorporated in all of the better types.

"Then the little, but most important item, cur bus bar construction will probably come in for some hot discussion during the next few months, for it appears that our bus bar connecting wire causes more losses in receiving sets than all the other losses combined. It will probably be found also that the shape of wire must be round and all nice right angle corners will soon be avoided.

"After all these losses have been reduced to almost zero, we shall have radio receiving sets that will be really efficient, and the writer makes the prediction that we will soon have ordinary crystal receiving sets made on low loss principles which will bring in real distance at all times.

"There is really no good reason why, in the future, a 100-watt station should not be received on the loud speaker at the furtherest distance possible on this globe, namely 12,000 miles.

"Our present-day radio receiving outfits may be compared to a heavily perforated soup ladle. As soon as we start ladling out the soup it escapes through the perforations. Some of the soup sticks to the sides of the ladle and in the spaces between the perforations. This is our present day radio outfit. Most of the energy leaks away in places we do not even suspect. Such innocent things as a sharp cornered binding post may give us tremendous losses. The future will show."

What did the writer of that 1925 editorial envisage the future would bring? Was it high "Q" coils, ceramic capacitors, the present day multi-element miniature radio valve, short leads, transistors? It is remarkable the number of forecasts made in 1925 which have become the basic principles of today's techniques.

Some of the advertisements and illustrations were an education in themselves, such as the one for: "The LoLos Explorer" —"Here is a 3-tube set that is positively a 'Knockout.' It contains a low loss 3-circuit tuner, a low loss condenser, low loss sockets, etc., and will bring in stations a thousand miles away on the loudspeaker, 15 stations logged in two hours — all on loudspeaker."

Then the one for: "The Condenser with the full floating axle — A Full Floating Automobile Axle" and shown with detailed illustration to prove the construction.

And of course the money saver was not forgotten in these claims: "Delivers 'B' current from the electric light socket. Suitable for any receiving set using 1 to 14 tubes—will also take care of power amplifier."

Other points of superiority stated were: "Requires no attention, does not run down or wear out." "Cannot burn out radio tubes even if wrongly connected." "Uses no tubes, there's nothing to repair or replace." "Constant voltage, plenty of pep." "Gives clear tone, greater volume and more distance." "It is noiseless, there's absolutely no hum or distortion." "Will operate a low power transmitter."

The unit for which those claims were made was referred to as a device for eliminating "B" batteries and delivered an abundance of current at 15 to 150 volts.

Then there was the "Tropadyne Kit" to quote: "The Tropadyne circuit is superior to the super-heterodyne. In the Tropadyne six tubes do the work of eight! And the Tropadyne brings in all the stations on an indoor loop."

The perils to mankind attributed to wireless were also recorded. An advertisement for "FoneKushions" used as a selling point the cutting from a newspaper, which read: "Radio rash is Europe's newest affliction. It is an eruption of the tender skin of the ears of wireless devotees, resulting from the constant pressure of the hard rubber headpieces."

***News and notes of Divisional and Club activities, submitted for inclusion in these columns, should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W.**

EIGHTH JAMBOREE-ON-THE-AIR

The 1965 Jamboree-on-the-Air, the event when Radio Amateurs join with the Boy Scouts in all parts of the world to provide local, interstate, and international communication links, will be held over the weekend October 16-17.

This year the occasion will be dedicated to the United Nations International Cooperation Year, and a distinctive participation certificate has been produced for those taking part.

The objects of the Jamboree-on-the-Air is to let Scouts and Guides talk to or listen to their brother Scouts—whether they be in the next town or in another country—and to learn about their activities, families, and homes. Also, to introduce them to amateur radio and electronics.

An appropriate address has been tape recorded by the Chief Commissioner of the Australian Boy Scouts Association, Mr C. R. Nichols. It is planned to transmit this recording as an opening message from official stations at 10 a.m. EST on Saturday, October 16.

Noel Lynch, National Organiser for the Eighth Jamboree-on-the-Air, has compiled and circulated to all branch organisers a Call book containing the call signs of all amateur stations in Australia who participated in 1964. It also contains information regarding the compilation of reports and rules to be observed by Scouting groups.

In 1964, 290 Australian amateurs helped 3,910 Scouts and Girl Guides to make 2,308 contacts, approximately 300 with overseas groups.

As in the past, the World Bureau Station VE3WSB in Ottawa, Canada, will be operating on all amateur bands and a special watch will be kept for Australian stations.

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NOTCHES ◂
TRIMS ◂

SHEET STEEL TO 18 GAUGE • ALUMINIUM, COPPER, BRASS, PUNCHING BAKELITE, OTHER SIMILAR MATERIALS to 16 GAUGE.

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YOU CAN CUT Round, Square, Irregular and Angled shapes any size over $\frac{7}{16}$".

YOU CAN TRIM Undersize holes, alter and enlarge shapes of holes.

YOU CAN NOTCH Clearances or Flanges on Flues, Air Ducts, Cowlings, Cabinets, Instrument Panels, Base Panels, Chassis, etc.

***PUNCHES REPLACEABLE IN MINUTES**

SAVES TIME LABOUR & COST.
A precision tool for custom-built radio assemblies, special sheet metal work in factory or home.

Note the Low Cost
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or direct from the Distributor:
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The claims for a receiver stated: "The Andrews Deresnadyne 5-tube set represents an entirely new principle in the design of radio circuits. The Deresnadyne circuit is the only circuit which stops the oscillation which produces whistling and distortion at its source. It stops oscillation in the plate circuit before it reaches the grid, which is extremely sensitive and where all adjustments are very critical.

"It is not like the neutrodyne, which neutralizes the excessive energy which produces oscillation. It prevents the generation of energy in excess of that which can be effectively used to produce undistorted signals.

"The exclusive principle of the balanced plate circuit makes possible the maximum amplification without distortion over the entire range of wave lengths."

After reading these extracts you can safely say the writer of the editorial was 100 per cent correct in his predictions of our reactions.

Will the claims made by today's advertisers and technical articles be the source of amusement when compared with commonplace equipment of 50 years hence?

To what extent will today's lasers, parametric amplifiers, micro-miniaturisation and solid state circuitry be the basic principles of future techniques?

W.I.A. Activities

JOHN MOYLE MEMORIAL NATIONAL FIELD DAY CONTEST

The results of the 1965 John Moyle Memorial Field Day contest in early February show a marked increase in the number of stations participating. Generally the scores of the award winners were much higher than in the 1964 contest.
the 1964 contest.

The award winners in the various sections were:

Section "A" (Portable Phone)	
VK1SB S. E. Brown.	484 points
VK2ASZ R. L. Lear	583 points
VK3ZRY R. L. HArrison	280 points
VK4ZK R. M. Feenaghty	925 points
VK5TH T. Mitchell	186 points
VK6MM M. J. McDonald	162 points
VK9XI R. Reed.	104 points
Section "B" (Portable C.W.)	
VK1SB S. E. Brown	152 points
VK2JM J. A. Mead	130 points
VK5ZF L. L. O'Donnell	318 points
VK9XI D. Reed	24 points
Section "C" (Portable Multi-op)	
VK1ACA Canberra Radio Soc.	901 points
VK2BWI VHF and TV Group N.S.W. Division W.I.A.	1176 points
VK3AWI W.I.C.E.N. Station of the Victorian Divis.	1648 points
VK5TM R. D. Martin	800 points
VK6VF West Australian VHF Group Inc.	400 points
Section "D" (Fixed Stations)	
VK1LF L. B. Fisher	195 points
VK2APK D. F. Kiesewetter	750 points
VK3APJ P. J. Dettmann	575 points
VK4LT A. E. Carter	685 points
VK5RG R. S. Gurr	255 points
VK7SM S. G. Moore	775 points
Section "E" (Receiving)	
WIA-L2188 C. R. Christiansen	720 points
WIA-L3138 G. N. Earl	805 points
WIA-L4018 C. H. Thorpe	215 points
WIA-L5065 A. Raftery	165 points
WIA-L6028 B. Prosser.	115 points

ITU CONFERENCE

The Plenipotentiary Conference of the International Telecommunication Union (ITU) opened in mid-September and is scheduled to continue for nine weeks.

The ITU Plenipotentiary Conference is the organisation's supreme authority. This year's conference, which takes place in the Union's Centenary Year, is only the ninth occasion on which such a meeting has been held in the ITU's 100 years of existence.

The founding conference met in Paris in May, 1865, and succeeding conferences took place in Vienna in 1868, Rome in

1871-2, St. Petersburg in 1875, Madrid in 1932. Atlantic City in 1947, Buenos Aires n 1952 and Geneva 1959.

The main purpose of the Plenipotentiary Conference is to revise the ITU Conven-ion—the union's basic charter. It also decides general policy and elects the secretary-general and deputy secretary-general.

For this year's conference, in Monreaux Palace Hotel, The Swiss Federal Government is acting as host. It was an-icipated that at least 115 of the ITU's 27 member countries would be participating, with a total of more than 500 delegates.

Amateurs will recall that the 1947 con-erence in Atlantic City and the Geneva conference of 1959, vitally affected the Amateur Frequency Allocations. Although no revision of frequency allocations is set down for the present conference, and no Amateur representative need be sent, it is ssential that provision be made for the Australian Amateur Service to be repre-ented in the future when such revisions re to be considered.

The Federal Council, Federal Executive nd all Divisional Councils of the Wireless nstitute of Australia urge all amateurs and ssociates of the Institute to contribute to he W.I.A. ITU fund. Contributions may be sent to Divisional Secretaries in all States of the Commonwealth of Australia or to Federal Executive, Box 2611W, G.P.O., Melbourne, Victoria.

Contribution to the fund will ensure that inance is available to send an Australian Amateur representative when it becomes ecessary in the future.

NEW SOUTH WALES DIVISION W.I.C.E.N.

Under the guidance of Vic Cole VK2VL, N.S.W. Division Co-ordinator, the activities of the Division's Wireless Institute Civil Emergency Network are being revived.

At a meeting held at Wireless Institute Centre, Crow's Nest, in mid-August, 20 in-erested members were present.

Following a general discussion on matters elating to W.I.C.E.N., a management com-nittee of eight was formed.

Committee members are:—

Vic Cole VK2VL, Kieth Finney VK2ARH, Don Miller VK2GN, Dave Duff VK2EO, Barry White VK2AAB, Peter Campbell VK2AXJ, Terry Brown VK2ZBL, Ian McKenzie VK2ZIM.

At the present time there are more than 20 stations operating on the 146MC FM net nd with the equipment available it s expected that there will be about 50 tations in the very near future.

A 146MC FM base station has been nstalled at the Division's trasmitting station t Dural, and various tests and exercises re planned. Moves are also in hand to nclude a 52MC AM net within the organi-ation.

Meetings have been set down for the econd Friday evening of each month at Wireless Institute Centre, 14 Atcheson Street, Crow's Nest, to discuss various aspects and plan a complete functional organisation.

All interested members are invited to ttend.

HUNTER BRANCH

A Sydney visitor, Mr David Pyke of Union Carbide, was the Lecturer at the August meeting of the Branch. Mr Pyke outlined his company's products and produced performance and temperature curves or the various cells and batteries in the ange. He also made particular mention of he newly introduced range of nickel-cad-nium accumulator cells which offer definite dvantages over the expendable dry cell.

Methods of recharging these were shown, ogether with some startling figures concern-ng discharge rates. At the conclusion of the ecture, an illustrated booklet was presented o each member of the audience, which umbered about 40. Among those present vere members of T.E.T.I.A. (Newcastle) and he Maitland Y.M.C.A. Radio and Elec-ronics Club.

The president of the branch, Fran Cox VK2APO, moved the vote of thanks to Mr Pyke.

Many local members were present at the Technical College on the August 20, as guests of the Newcastle division of the I.R.E.E. to see a most convincing practical demonstration of the LASER by Dr J. V. Ramsay, a chief research scientist of the C.S.I.R.O.

Dr Ramsay described the LASER in terms which could be understood by all and went on to display two LASERS of the helium/neon type operating at 632nm in the red spectrum.

The output of the type shown was 1 milliwatt but, Dr Ramsay said, the beam would have a useful range for communication over about 50KM.

The Chairman of the Newcastle division of the I.R.E.E. Mr Chris Cowan VK2PZ, has issued an invitation to Hunter Branch members to be present at future meetings of the Institution. Details of forthcoming meetings will be announced from VK2AWX during the weekly broadcasts.

There was a good deal of activity from the branch during the "R.D." contest and several local stations made commendable scores. Bill Hall VK2XT seems to have scooped the pool with 168 contacts while the Westlakes Club Station made 142 contacts with Allen Legge as operator. Others participating in the contest were VK2AEE; VK2APO; VK2BSB; VK2BJO; VK2AHA; VK2AKX and VK2AWX.

In the state run VHF section most operators in Newcastle and suburbs were active, together with others from the New England and coast areas. Top scorer for the Branch and provisional winner for the State is Tony Mullen VK2ZCT of Whitebridge who made 162 contacts for 403 points. Tony won this event in 1964.

The next Hunter Branch meeting will be held in Room 6, Clegg Building, Newcastle Technical College, Tighes Hill on Friday, November 5, commencing at 8 p.m. Details of the meeting will be notified in the weekly column "News of Radio Amateurs" in the "Newcastle Morning Herald" each Saturday and also from VK2AWX in the weekly news broadcasts. The broadcasts are made on 1815KC, 3595KC and 7050KC each Monday at 7 p.m.

Visitors are always welcome at Hunter Branch meetings.

VHF and TV Group

According to reports there is a growing interest in SSB operation on two metres. Among the stations at present operating on this mode are VK2's ZRU; ZRH; ZVL; XA; AAK; ZIF and HE.

Interested members are at present working on a transverter to enable 14MC SSB equipment to be operated on 144MC. It consists of a 130MC crystal locked mixer and a matching converter.

With increasing interest in the two and six metre hidden transmitter hunt events, an up-to-date set of rules for "hunt events" has been printed and copies are available from Tim Mills VK2ZTM personally or by sending a self-addressed stamped envelope to "Newsletter," Box 342 P.O., Crow's Nest, N.S.W.

The New South Wales group have planned a large scale field day to be conducted over the New Year holiday weekend. Details of the proposal and times for intensive DX tests have been sent to all HF groups in Australia and New Zealand.

It is pointed out that last year's field day results indicated that DX contacts could be made in the early morning and late afternoon. It is with this in view that a series of tests across the Tasman is proposed. More details in later notes.

CENTRAL COAST STATION

On the rather cold night of August 20, twenty-six members attended the usual monthly meeting of the Central Coast Amateur Radio Club. A talk on the construction and use of capacitors in radio was given by Roy Robinson of Ducon Industries which proved to be a very in-

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5in x 7in	15-3.5	**47/6**
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9in x 6in	15-3.5	**55/-**
12in	15-3.5	**82/6**

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5in Twin Cone 4W 15 OHM	**45/-**
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TO1 Output 375 OHM C.T.-3.5 OHM 500 MW	**16/**
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6F6	12/6	
6F8	5/-	
6G6G	7/6	
6G8G	26/-	
6H6GT	3/6	
6J5GT	10/-	
6K7	5/-	5 a £1
6K8GT	12/6	
6L7	5/-	5 a £1
6R7	7/6	
6SC7	7/6	
6SF5	7/6	3 a £1
6SF7	7/6	
6SH7	4/-	5 a £1
6SJ7	12/6	
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6SS7	7/6	3 a £1
6U8	17/-	
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30	1/3	
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830B	15/-	
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866	25/ each	
954	5/-	5 a £1
955	5/-	5 a £1
956	5/-	5 a £1
958A	2/6	10 a £1
1616	20/-	
1625	5/-	5 a £1
1626	5/-	5 a £1
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5763	28/-	
6146	£3/17/6	
6360	£2/10/	
9004	5/	5 a £1
AV11	2/11	
EA50	2/-	10 a £1
ECC35	20/-	
ECH33	20/-	
ECH35	7/6	
EF39	5/-	5 a £1
EF50 (VR91) and socket	3/6	
EF70	5/-	5 a £1
EF72	5/-	5 a £1
EF73	5/-	5 a £1
EF86	26/-	
EL41	10/-	
EY91	5/-	
KT61 (6V6)	15/-	
QQEO3/12	47/6	
QQE04/20	£3½	
QQV06/40	97/6	
UL41	7/6	3 a £1
VR53	5/-	5 a £1
VR99A	7/6	
VR100 (6U7)	7/6	
VR102	5/-	5 a £1
VR136	2/-	12 a £1
VR137	2/6	
VT78 (6D6)	5/-	
VT127	4/11	5 a £1
VT501	7/6	3 a £1
6SK7GT	21/-	
6SL7GT	12/6	
5Z3	17/6	
802	20/-	
6AG5	5/-	

teresting and instructive lecture.

Among the points discussed were the size and types, reliability, and precautions to be taken when designing equipment.

The vote of thanks to the lecturer was proposed by Phil Levenspiel, VK2TX, who recalled a very vivid memory he had of a discharge from a capacitor that had been left on a shelf for some monhs.

It is also reported that several interested members will be joining the 146MC FM W.I.C.E.N. net.

Lindsay Douglas VK2ON is on a two month business trip to Canada, United States, and England. He hopes to meet many amateurs and will no doubt bring back the latest information on SSB.

Visitors are very welcome to attend the monthly meetings of the Central Coast Section held at 7.30 p.m. on the third Friday of each month at the School of Arts, Gosford.

NARRANDERA RADIO CLUB

The annual meeting of the Narrandera Radio Club was held on Tuesday evening, July 28, when there was a good attendance of members.

The officers appointed for the coming year were:—

President, Don Fullerton, VK2DU; Vice-Presidents, Michael Gilmore, Assoc., Harry Cuthbert, VK2AEC; secretary-treasurer, Mrs Val Gilmore, Assoc.

By unanimous vote the meeting night for the club was changed to the Friday evening each week. It was also agreed that membership fees will remain the same. It was also decided to start providing some test equipment for member's use, and the first unit is to be a multimeter.

Following the meeting three interesting and instructive films were screened. They were: '"Photo-conductive Effect," "The Sunwhite Story," and "From us to View."

It has also been reported that the Narrandera Club's eldest member, Ol Parker was successful in gaining his A.O.L.C.P.

The progressive club caters for those living in the Riverina area of New South Wales and a cordial invitation is extended to amateurs who may be travelling through the district, to visit the club meetings.

VICTORIA

The Annual Dinner of the Victorian Division will take the form of a Dinner Dance in the Governors' Room, Menzies Hotel, on Friday evening, November 5.

Tickets are £2/12/6 single, and £5/5/ double. Full details can be obtained from Doug Bowie VK3DU.

VHF Calendar

VHF Convention: October 9 and 10.

Field Days: October 17, November 21, December 19.

Full details will be given from VK3WI during Sunday morning News Broadcasts.

QUEENSLAND

The results of the 1965 "Sunshine State Contest" were:

Outright Winner: Reg Vickary VK4VX.

H.F. Bands: Geoff Fox, VK4FK.

V.H.F. Bands: Lloyd Dobbs, VK4ZLO.

Listener's Award: Charles Thorpe, L4018.

From observations made during the contest it seems that 20-metre operation will be omitted from future contests; also that improvements to give a more equitable and easily workable method of scoring may be possible. On these points suggestions from members will be welcome.

MORSE PRACTICE SESSIONS

Two morse practice sessions are being transmitted each week on behalf of the VK4 Division by Jeff Thompson, VK4XP. The transmissions commence at 7 p.m., and continue until 7.30 p.m. on Monday and Thursday evenings on 3504KC in the 80-metre band. These transmissions are designed to assist candidates to bring their morse up to the standard for the A.O.C.P. examination.

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P25 5 Ma. 47/6
P25 10 Ma. .. 47/6
P25 20 Ma. .. 47/6
P25 50 Ma. .. 47/6
P25 100 Ma. .. 47/6
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P25 300v AC .. 47/6
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P25 VU Meter .. 75/-
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MR1P 1 Ma. 32/6
MR1P 500 uA. 35/-
MR2P 1¾ inch square clear plastic, 1½ inch round mounting hole: 1½ inch deep.
MR2P 50 uA. 55/-
MR2P 50-0-50 uA. 55/-
MR2P 100 uA. 47/6
MR2P 500 uA. 37/6
MR2P 1 Ma, 5 Ma, 10 Ma, 15 Ma, 20 Ma, 25 Ma, 50 Ma, 100 Ma, 250 Ma. ALL .. .. 35/- each
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MR2P 15 Volt D.C. 37/6
MR2P VU Meter 45/-
MR2P Stereo Balance 42/6
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(S Meter reads S1 to S9 + 10 to 30db FSD 1 Ma.)
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MR3P 3 x 3 3-8 inch square clear plastic, 2¾ inch round mounting hole, 1½ inch deep.
MR3P 50-0-50 uA. £4/2/6
MR3P 50 uA. £3/12/6
MR3P 500 uA. £2/17/6
MR3P 1 Ma £2/10/0
MR3P 5 Ma, 10 Ma, 25 Ma, 50 Ma, 100 Ma, 250 Ma, 500 Ma. ALL .. 50/- each
MR3P VU Meter £3/17/6
MR3P 300 Volt A.C. £2/10/0
MR52 2½ inch square, black plastic, 2 inch round mounting hole, 1¼ inch deep:
MR52 100 uA. 62/6
MR52 500 uA. 47/6
MR52 1 Ma, 5 Ma, 10 Ma, 25 Ma, 50 Ma, 100 Ma, 250 Ma, 500 Ma. ALL £2 each
MO52 2 5-8 inch round face, 2½ inch hole, black plastic case.
MO52 500 uA. 38/6
MO52 1 Ma. 36/6
EW-20 Edgewise Meter 2¼ x ¾ inch rectangular clear plastic case, 2 inch deep:
EW-20 1 Ma. 42/6
EW16 Edgewise Panel Meter 1 x 3¼ inch face, 3½ inch deep:
EW16 500 uA. £3/17/6
EW16 1 Ma. £3/7/6
EW16 300 volt A.C. £3/17/6
MR65 3¼ inch square face, 2½ inch round hole, black plastic case:
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MR65 1 Ma, 5 Ma, 10 Ma, 25 Ma, 50 Ma, 100 Ma, 250 Ma, 500 Ma. ALL 50/- ea.
MR65 50 Volt AC 47/6
MR65 VU Meter £4/2/6
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MO65 500 uA 37/6
MO65 1 Ma, 5 Ma, 10 Ma, 20 Ma, 50 Ma, 100 Ma, 150 Ma, 250 Ma, 500 Ma. ALL 35/-each
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MR4P 1 Ma £3/5/0
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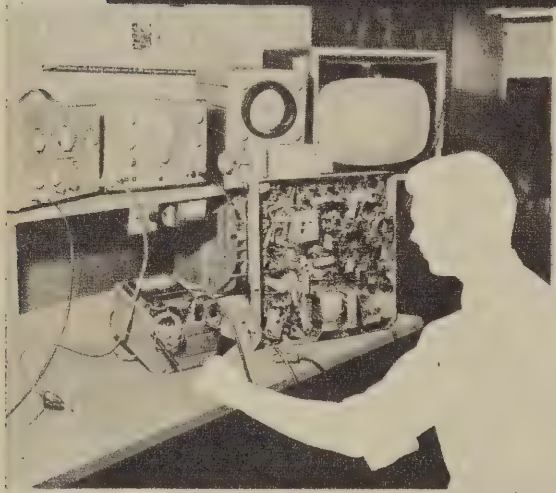

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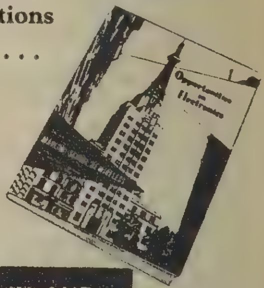

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1965 REMEMBRANCE DAY CONTEST

1965 Remembrance Day Contest

From the activity on the amateur bands on Saturday evening, August 14, and Sunday, August 15, there should be many high scores submitted. It would appear that the contest has lost none of its attraction to the older amateurs, and the inclusion of a VHF-UHF section added to the general interest.

The official opening address broadcast over all Divisional Stations was made by Maj.-General Ivan M. Dougherty, C.B.E., D.S.O. and Bar, E.D., B.Economics, who holds the position of Director of Civil Defence in New South Wales.

Prior to declaring the contest open Maj.-General Dougherty said:

"I am pleased, indeed, to accept your invitation to address the Radio Amateurs of Australia, both 'OMs' and 'Yls', on the occasion of the Eighteenth Annual Remembrance Day Contest.

"Since the first 'RD' was conducted in 1948 by your Institute, the Wireless Institute of Australia, there has been an increased interest in the contest, which is held annually at this time of the year, to perpetuate the memory of those Australian amateurs who gave their lives for their country during World War II.

"A particularly significant aspect of the contest is the fact that it is based on team work. The trophy is not awarded to any one person. It is awarded to the division of the institute that achieves the highest score, and this is based on the combined efforts of all the participating amateurs in each division. This is of particular interest to me, because it demonstrates that the combined efforts of many, each doing perhaps only a little, with the burden not resting on only a few, really brings the most satisfying and worthwhile results.

"One of the reasons why I am pleased to be associated with the 'RD' contest, is that, in inviting me, as the Director of Civil Defence for New South Wales to address you, the members of your executive have reaffirmed on your behalf, your interest in community service in times of emergency.

"There is a long history of amateur participation in all sorts of disasters. The most recent of these was on the occasion of the terrible fires in Victoria in March this year, when a number of VK3 amateurs rendered valuable assistance over a period of eight days, to the various civil authorities engaged in the fire fighting operations.

"Although there has been really wonderful progress made in the extent and in the reliability of our main Australian communications system, which has been developed by the Postmaster-General's Department, and there are many cases of special alternative means of communications provided by various organisations, the fact remains that the unexpected will always occur when emergency operations are in progress. The knowledge that there are so many experienced amateurs, willing and ready to render service, is particularly valuable when one is engaged in such operations.

"All that I have said so far is well known, of course, to the older members of the amateur fraternity. I think it appropriate that I should address some special remarks to the younger amateurs among you. There are quite a number of you who still attend school, including a number of 'YLs'. The Youth Radio Scheme is to be particularly commended for the great progress in this field, and I am sure you appreciate the efforts of those older amateurs who conceived the idea of the scheme, and who have put it into operation so successfully.

"You have been fortunate to grow up in a country that is moving ahead in all spheres of activity, a country that has not known the conflicts that have ravaged most other countries from time to time. It is fitting that I ask you to give a special thought to those amateurs whose memory we keep alive when you participate in the 'RD' Contest. The sacrifices they made have done much towards making Australia such a wonderful place for young people to grow up in, and learn to accept their responsibilities as citizens.

"You have a wide field of knowledge to draw on from the older amateurs, and a most interesting and exciting area of exploration of technical advancement for the future. The techniques of solid state circuitry, micro-miniaturisation, lasers, and communications satellites, are only some of the fields open to your enquiry and experiment.

"It is here, I think, that we find the true value of amateur radio to the community. While engaged in a hobby, you are giving yourselves technical and operating experience which makes you more valuable members of society; experience which, apart from the pleasure you gain, can be put to good use in the interests of your fellow citizens should the occasion arise.

"To young amateurs therefore, I offer a special word of encouragement to pursue your hobby while, at the same time, keeping in mind the traditions of service so faithfully observed by the older amateurs, particularly those whose memory we foster in the 'RD' Contest.

"To all amateurs taking part in the Contest, I send my very best wishes for plenty of high scoring 'QSO,' may you operate without too much 'QRM', and when you pull the big switch tomorrow night and total up your log, the experience you have gained will, I am sure, prove to be valuable both to you and your country.

"It is with very much pleasure indeed, that I now declare this, the Eighteenth Annual Remembrance Day Contest open, and ask you to stand by for the reading of the Roll of Honour."

* * *

SOUTH AUSTRALIA

The Annual meeting of the Elizabeth Amateur Radio Club was held on August 7 when the President, C. J. Hurst, VK5ZHJ, presented his report on the activities of the past year. Some of the highlights of the report were:—

"The past year has once again been marked by increased membership and activities within the Elizabeth Amateur Radio Club. The total membership at the present time stands at 64. It has been most gratifying to note the marked increase in attendance at club meetings regardless of the doldrumic state of the amateur bands.

"As is customary, club members threw themselves wholeheartedly into the Remembrance Day Contest. The 1964 contest saw an excellent participation by VK5 amateurs, to the extent that the State Trophy is now resident in South Australia. Needless to say E.A.R.C. members contributed greatly to this result. Once again the Battle of the Champs highlighted the contest, when, for the second successive year Jeff Vale VK5ZP was the outright winner with Jeff Whyte VK2AHM being again forced into second place. It was gratifying to note the excellent contribution of high-scoring logs by club members to assist the VK5 State score.

"During the past year the Elizabethan Award has again been in demand. Although the applications for the Award have been rather limited due to the low level of activity on the bands, it is anticipated that the rising sunspot activity will provide a flood of applications from amateur stations situated throughout the call areas of the world."

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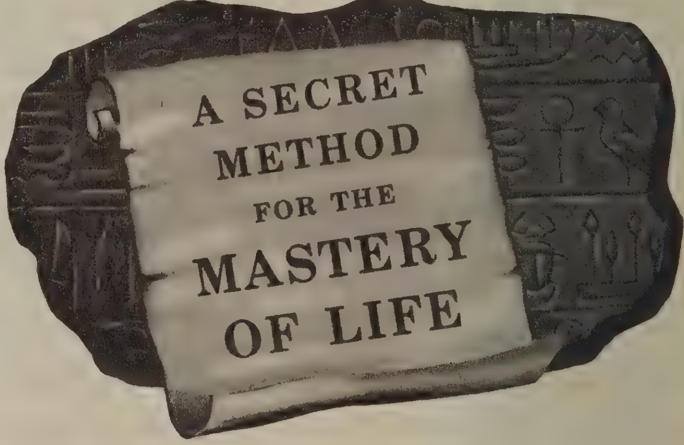

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Other points mentioned in the report were:— The participation by club members in the John Moyle Memorial National Field Day, the club magazine "Info" and the operation of the Q.S.L. bureau. And not forgetting the popular Christmas Social.

The report concluded: "In closing, I wish to thank all club and committee members for their unlimited support during my term of office and sincerely hope that in the ensuing years the E.A.R.C. will expand and further consolidate its ranks to maintain the true purpose of Amateur Radio and its code of friendly and cordial world wide communication."

Club members will be pleased to welcome new members to the Club Meetings which are held in the Elizabeth South Primary School on the first Saturday in each month, at 8 p.m. Details of all club activities may be obtained by writing to the Hon. Secretary, W. N. Thomas, VK5VE, Elizabeth Amateur Radio Club, Box 8 P.O., Elizabeth, South Australia.

WESTERN AUSTRALIA

It has been reported that efforts are being made to organise an active W.I.C.E.N. group by the West Australian Division. While many members have fully mobile HF and VHF equipment in operation and have proved their ability to handle emergency traffic, difficulty is being experienced in getting the local Civil Defence authorities interested in the project.

The co-ordinator, Brian Pemberton, VK6VW, is anxious to hear from anyone interested in joining the group and is working hard to gain recognition for W.I.C.E.N. similar to that of the Victorian Division.

The Annual Meeting of the VHF Group held in August was well attended and the following officers were elected for the ensuing year.

Patron: Mr Frank Dawson. President: Harry Pride, VK6HP. Vice-President: Don Graham, VK6HK. Secretary: Graham Sturcke, VK6ZEZ. Council: Brian Pemberton, VK6VW, Graham Byass, VK6ZDB, Wally Howse, VK6ZAA, Keeper of Records: Charles Kosina, VK6LK. Bulletin Editor: Wally Howse, VK6ZAA. Press Correspondent: Barry Chester, VK6ZCF. Librarian: Rolo Everingham, VK6BO. Q.S.L. Officer: Laurie Jessop, VK6ZEA. Trustees: Ron Mould, VK6FM, Syd Smith, VK6SJ. Auditors: Jon Kitchen, VK6ZAG, Michael Dooley, Assoc. Program Director: Tom Berg, VK6ZAF.

TASMANIA

The following office bearers were elected for the forthcoming year at the Annual Meeting of the Tasmanian VHF Group: President, I. A. Nichols, VK7ZZ, Vice-Presidents, G. C. D'Emden, VK7ZAS, M. J. Knott, VK7ZMK; Secretary-Treasurer, B. M. Muir, VK7TX; Broadcast Officers, J. F. Grace, VK7ZJG, K. M. Kelly, VK7LL; News Officer, B. M. Muir, VK7TX; Activities Committee, P. L. Corby, VK7ZAX M. J. Knott, VK7ZMK, VK7KZ; Research Officer, G. C. D'Emden, VK7ZAS; VHF Scribes, W. J. Emmett, VK7ZAQ, B. J. Riddell. Assoc.

W.I.A. YOUTH RADIO SCHEME

NEW ZEALAND

The New Zealand Association of Radio Transmitters have instituted a Youth Radio Scheme along lines similar to the W.I.A. scheme.

Details of the scheme were published in the August edition of the Association's Magazine, "Break-in," which will no doubt prove to be of great assistance to students interested in radio and electronics.

It is hoped to include precise details in the next edition of these notes.

NEW SOUTH WALES

There are 32 Clubs affiliated with the Y.R.S. in New South Wales, the latest to register was the Ryde High School. This Club consists of Fourth Form students under the guidance of Mr Fowler of the Manual Arts Department.

Club leaders who might be interested in arranging an inspection of the P.M.G. Dalley Street Telephone Exchange should contact Mr Charles Stoddart at the P.M.G. Department's Publicity Officers' Section.

Conducted tours of about two hours' duration may be arranged for groups of 12 to 15 boys, who will be given a good idea of the work situation they would encounter in the P.MG. service. This could prove valuable for Vocational Guidance purposes.

On behalf of Vista Recording Studios in Newcastle, Mr Len Daley VK2ZFD, donated a choice of items to two lads who recently gained the Junior Radio Certificate. Graeme Hough of Kingsgrove High School received an 0-1 milliameter and Bruce Lewis of Kingsgrove North High received a crystal microphone.

Both presentations were made at School Assemblies, the first by the Headmaster, Mr E. Gilbert, B.Sc., and the latter by the Science Master, Mr Don Kerr, B.Sc.

An experiment which appears to have distinct possibilities, is the formation of Postal Groups for lads who cannot attend School Radio Clubs. At the present time four groups are operating. Group 1 is conducted by John Thyrd, formerly of Kingsgrove North High, now with D.C.A. Radio School; Group 2 by Mrs Mona Swinton, VK2AXS of Kulnura, Group 3 by Rodger Davis, VK1RD, formerly of Lyneham High and Group 4 by Susan Brown, VK2BSB, formerly of Booragul High, now of the Westlakes Radio Club and Newcastle University.

A note of interest to Club Leaders is that Mr J. H. Skipper of Philips Electrical Pty. Ltd., 69-79 Clarence Street, Sydney, advises that his company is starting to market a range of Electronic Kits which may be of value in Y.R.S. Clubs.

WESTLAKES RADIO CLUB

Two members of the Westlakes Radio Club have been notified of their success in the Elementary Radio Certificate examination conducted by the Youth Radio Scheme. They are Paul Linsley and Allen Legge. Allen is now awaiting the award of his Telephony Operators' Certificate—Grade 3. Another examination for the Elementary Radio Certificate was held at the club on 28th August and it is expected that more awards of certicates will be announced soon.

VICTORIA

Two blind boys from the Royal Victorian Institute for the Blind, Cheng Cheok and Norman Salmon have passed their Elementary Certificate examination. This is the first time such an achievement has been made in Australia. Incidentally Cheng comes from Singapore.

Mr Turley, Director of the R.V.I.B. invited Cyril Minns, VK3AUM, himself a blind amateur operator, to present the two framed certificates. This he did after an excellent address to the boys.

Max Hull, Federal President of the W.I.A., presented the boys with a set of screw drivers, donated by the Turner Manufacturing Company of Nunawading, Victoria.

Mr N. Wyatt on behalf of the Anodean Sales Division donated £20 worth of radio parts to the Club.

QUEENSLAND

The Youth Radio Scheme in Queensland appears to cover many more square miles of territory than in any other State. A report on the Y.R.S. published in the Queensland Division's magazine "QTC" refers to flourishing Clubs such as the Christian Brothers College, Mackay, the High School at Mt Isa, St. Joseph's Christian Brothers College, Rockhampton, and the Prosperine Scouts Club. At all these Clubs the boys are making excellent progress at the Elementary Certificate level, while at Gympie Club they are awaiting the results of the Junior Certificate exams. ■

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Latest ½ Track. Hi Fi.
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Takes 7in spool.
3 speeds 1⅞, 3¾, 7½ i.p.s.
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Write for particulars.

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12v. D.C. Input. 300v. 150Ma. Output plus 150v. Output.
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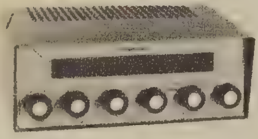

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106
WIRED AND TESTED. **£42**

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3 Watts per channel. 240V. A.C. Operation.
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With 8in Twin Cone Speakers Fitted, **£9/10/- Each**

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Simple installation.
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Complete. Tested.
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State voltage and polarity.
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1 watt. 15 transistor, with squelch provision for two channels. Range to 60 miles under ideal conditions.

£88/-/- PER PAIR

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2 Station Transistorised
£5/15/-
4 Station including Master
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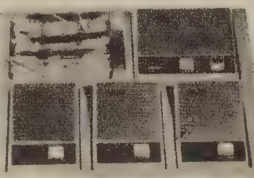

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Transistorised.
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New 10-channel Tuners.
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240V A.C. Mono	£5	15	0
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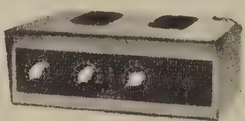

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15 WATTS OUTPUT.

Multimach Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing. P.P. EL.84 output.	£17/15/-
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5/10 with pre amp base and treble boost. Ultra Linear output	£21/15/-
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240-270V 50 cycle 5 amp.
Provide infinitely variable AC voltage.
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As above with buzzer.
Complete Morse practice set,
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Pickup Units	£4	7	6
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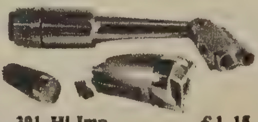

DM -391 Hi-Imp	£1	15	0
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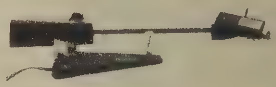

Ceramic Units. Sapphire Styli	£3	10	0
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NEW WIDE RANGE SPEAKERS

15 ohm. Twin Cone

8in	3	10	0
12in	3	19	6
5in	2	5	0
5in Tweeter	1	17	6
4in Single Tweeter	1	7	6
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P.A. REFLEX HORNS

WITH UNITS

5 Watt 8 ohm	7	5	0
10 Watt 8 ohm	13	5	0
35 Watt 15 ohm	18	0	0

N.B.: As these are American ratings, divide the wattage by 2.

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1965 model. 4-speed.
£10/15/
De Luxe Model.
Fully machined and balanced. Heavyweight turntable. Ceramic cartridge.
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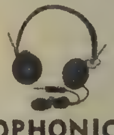

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With padded earpieces
SPECIFICATION . . . .
Frequency Response 25—17000 cps.
Nominal Power 1 watt.
V.C. Imp. 8 ohms each channel.
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PHILIPS DISC JOCKEY

4-Speed Players.
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15 Watt £27/15/-
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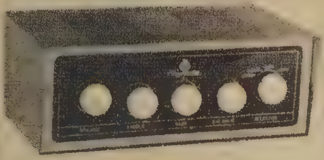

PLAYMASTER 2 STEREO AMPLIFIERS

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£31

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Vibrato with foot control and 2 pre-set controls for frequency and intensity. £5/5/- extra on above models.

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With Reverberation. May be used as 28 Watt or as 14 Watt plus 14 Watt Reverb, 2 9 x 6 Woofer Speakers. 2 9 x 6 Twin-Cone Speakers. 4 Channels. Bass and Treble Boost. Foot Vibrato Control included.

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4 Input Channels. Bass and Treble Boost. 2 12in Radial Beam Speakers. Perfect reproduction on 20 cycles.

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45 Watt	£49	17	6
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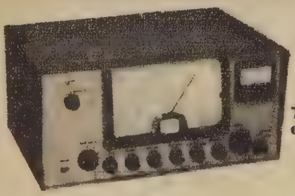

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Post 2/6 per Spool.

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8 WATT
8in Units in Waterproof Projection Horns.
15 Ohm Voice Coils.

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In Double Ended Flares. Duolateral Coverage.

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Line Output Transformers to suit. 17/6 extra.

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American Rating. 30 Watts. Voice Coil 16 ohm.

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Trickle Charge Position suits all Batteries. 2V to 12V at rate of 200 to 500 M.A.

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1½ amp., 6v-12v	£4/17/6
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Rail or Air Freight on.

Cabinet only £5/15/.
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To R. TV & H specifications. Mountain Ash, Maple or Walnut finish.

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Also to suit. 8 W.R. and new Magnavox HF5SIC Tweeter.

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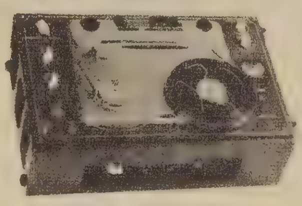

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MARCH-APRIL ISSUE, 1962

Complete kit set as described including Collaro, Stereo Deck.
With latest Michigan Heads and required modificatons.

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Steel Cabinet to fit.

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Wired and Tested. Complete in Cabinet with Tape. 2 Dynamic Microphones. Guaranteed.

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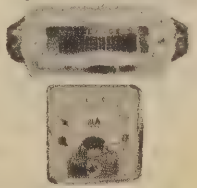

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Latest P series ¾in Barrel 50 mmA. 200 mmA. 1mA. 10 mA 500mA. 1 Amp, 10 Amp. 15V. 500V. **From £1/10/-**

MULLARD FERRIER TACHOMETER

Wired and tested.

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INCLUDING DWELL. ANGLE FACILITY.

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D.C. Volts 5, 25, 125, 500, 2500. A.C. Volts 10, 50, 250, 1000. Current. 250uA. 250mA. Resistance 0-10K, 0.1 Meg.

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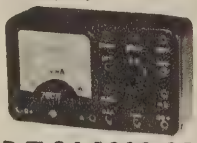
£10/7/6 Post, 7/6.



P.T.34 1000.OPV

D.C. Volts. 0, 10 50, 250, 500, 1,000.
A.C. Volts. 0, 10, 50, 250, 500, 1,000.
M.A. 1-100-500 RESISTANCE.

£2/12/6 Post 5/.

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27 Ranges A.C. Powered.
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A.C.V. P. to P. 0, 1.4, 4, 14, 40, 140, 400, 1,400, 4,000.
Resistance 1 ohm to 1,000 megohm.
D.B. — 10 D.B. to + 65 D.B.

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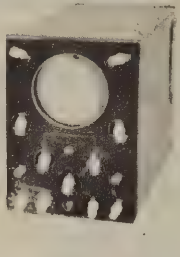
T.M.K. Units, £26/15/-

TEST EQUIPMENT



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5 Meg. Bandwidth. Push-pull vertical and horizontal Amplifiers. 8 position, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard-time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

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Simple to operate Quick, accurate visual indication of condition, operation and faults in spark plugs, coil points, condenser, gap settings, etc. Latest American design. Will pay for itself within 1 month on electronic tune-ups.
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Tape. Amplifier. May issue. Complete. Stereo Tape. Amplifier. 5 watts per channel.

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12 watts per channel. Equal to 101 amplifier. Wired and tested. Only

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The Complete 110 Tape Recorder in Cabinet with 4 Speakers as in Bookshelf Units. B.S.R. 4 track. 3 head. 3-speed deck. 12 Watts per channel. 2 Mikes. 1800ft Tape. Wired tested. Guaranteed.

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Freq. 120KC—260MCS in 6 bands.
Output (RF)—High 100,000uV max. Low 100uV max.
Output (Audio)—400 cps approx. 8V.
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Transistorised. Fountain Pen sized Unit for Signal Tracer in Radio, TV and Amplifier Service.

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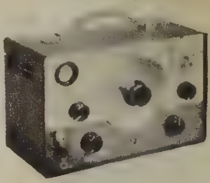

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Capacity 20 pfd to 2,000 mfd.
Resistance 2 ohm to 200 megs.
Also tests power, factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs. at 600V.
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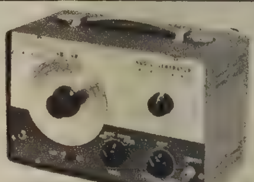

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Sine and Square Wave.
20 Cycles to 200 KC. 4 Bands.
Frequency response plus/minus 1.5 D.B.
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Output impedance 5,000 ohm.
Output volts, 0 to 7.

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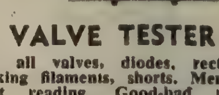

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LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

RADIO GHANA EXTENDS SCHEDULES

Radio Ghana in Accra has opened further high-powered transmitters and extended its schedules, which now include a special transmission in English to Australasia.

RADIO Ghana is possibly the first African station to carry special transmissions in English for listeners in Australia and New Zealand. This transmission is on the air 0600-0645 on 9760KC and gives very good reception. The program opens with the time signal and the familiar drum beats of Radio Ghana then news and commentary, news about Ghana and, on Friday at 0630, a letter box session in which letters from listeners with questions on Ghana are answered. The station, which we have previously reported as testing to North America and Europe, has been using 6130, 6110, 9545 and 9760KC for these 45-minute broadcasts. It is presumed that after the audience is known from reports from listeners, these broadcasts will form a daily feature of Radio Ghana. Reports should be sent to External Service, Radio Ghana, Box 1633, Accra.

The external services of Radio Ghana on short wave were first opened in Tema, by President Nkrumah in 1961. The latest expansion includes three television stations, the most modern in Africa, and six 10KW transmitters for internal services. These Marconi transmitters are at Ejura, and use vertical incidence aerial arrays supported on 16 masts of heights varying up to 1000 feet. Two further 250KW high frequency transmitters have been installed, and this extends the facilities already provided by the Tema station.

The new transmitters have resulted in signals on several new frequencies in the 90M band being received. Rex Gillett, of Adelaide, reports that the station has been noted on two new frequencies, making four channels in all in this band. The new channels are 3240 (in English) and 3280 (in French). Both sign off at 2215GMT. Ghana is still heard on 3350 and 3365KC, two of its older channels, and the services on these two frequencies have also been extended.

RADIO LEOPOLDVILLE

Radio Leopoldville in the Congo is reported by John Bowyer, of Beaumaris, Victoria, at good level at 2200GMT on 4725KC. The station has an announcement in French and, before the English news at 2200GMT announces, "This is the heart of Africa calling you from Leopoldville, the Democratic Republic of the Congo." Then follows news to 2205GMT, after which French programs are again carried on this frequency. Reference is made to a medium-wave station on 1331KC which serves the Leopoldville area, and also stations in the 5 and 41 metre bands.

OTHER SIGNALS FROM AFRICA

Africa provides some of the most interesting listening and reception in the 60 and 0 metre band. Rex Gillett, of Adelaide, and John Bowyer, of Melbourne, provide news of most interesting signals from the African area, reception being as late as 2230GMT, which is beyond the reception period for New Zealand readers, but can still be enjoyed by listeners in Australia.

3225 ELWA Monrovia, Liberia, has news in English at 2230GMT.

3265 Lourenco Marques Radio, Mozambique, with an English program, also on 3215KC, has been heard to sign off at 2100GMT.

3270 Radio Zambia, heard with English to 2200GMT.

3326 Lagos, Nigeria, is heard with good signals in South Australia to sign off at 2230GMT. A relay is also carried on 3395KC with the Lagos program.

3340 Radio Uganda, Kempala has English to sign off at 2100.

3350 Accra, Ghana uses this new frequency for English to sign off at 2230. Ghana is also being heard on 3365KC.

3375 Radio Official Angola, Launda, Angola is heard on this channel, as well as 6025 and 4820KC, with programs in Portuguese.

4720 Radio Leopoldville, Congo, has a news bulletin at 2200GMT, and also announces the transmissions in the 25 and 41 metre bands.

4777 Radio Gabon has been heard at 2130GMT, when the program is in French.

NIGER is understood to be the location of the station being observed in South Australia and Europe on 3260KC. The station has programs in French before sign-off at 2115GMT. Signals are weak.

ALGIERS as well as being heard by us on 6080KC has now been reported on 6175KC by Rex Gillett, of Adelaide. We assume this to be the change of frequency for the former 6050KC reported by Bob Radula, of Melbourne. The station has English at 2200, Spanish at 2230 and sign-off is 2300GMT. The station uses the announcement "Algiers, Radio and Television of the Algerian People's Democratic Republic."

RADIO KABUL

Verification letter from Radio Afghanistan at Kabul shows some reduction in the number of foreign languages broadcast on short wave. The present schedule does not list the former sessions in English at 1030 and 1100GMT, but gives foreign language transmissions as follows.

GMT		KC
1000-1030	Arabic	11945
1330-1400	Urdu	4775
1400-1430	English	4775
1730-1800	Russian	4775
1800-1830	German	15225

ENGLISH FROM MIDDLE EAST

Many stations in the Middle East area have been observed with English news bulletins. Most of them give good reception, and enable new countries to be added to the log. Some of those heard in recent weeks include the English transmission of Radio Ankara in Turkey using 15160KC at 2200GMT, following a Turkish program. Iran, over Radio Teheran, has good signals (100KW transmitters) on two frequencies, 11730 and 15110KC, with English at 2000-2030. The station recently verified our reception with a new verification card for the higher powered transmitter. Radio Baghdad in Iraq has two 49M channels in use for its English session 1930-2000. These are 6030 and 6095KC. Jordan using the slogan "The Voice of the Holy Land" and broadcasting from Amman uses 9560KC for its English program 0115-0135GMT. Israel from Jerusalem on 9625 and 9009KC has English from 2045 to 2115GMT, while Lebanon has English from 1830 to 1900GMT on 11770KC. Damascus, in Syria, using 15165KC has a 15 minute session in English from 1800 to 1815GMT.

ROME EXPANDS SERVICES

Radio Television Italiana has expanded its transmissions in several languages and new transmissions in English are now heard at the following times,

GMT	ZONE	KC
2115-2130	Great Britain,	9575, 11905KC.
1235-1255	Africa,	6010, 9630, 11905.
1200-1220	Near East,	6010, 9575
2205-2225	Japan,	9710, 11905
0100-0120	North America	9630, 11905.
In French		
1230-1255	Europe	5985, 7235.
1455-1520	Morocco	7155, 11810.

TESTS FROM ETLF

During October and November, Radio ETLF, The Voice of the Gospel in Addis Ababa, plans a series of tests to the Americas and the Pacific area. The transmissions, in English, will enable the station to evaluate reception, and also the listening audience, in these areas. At present the station's transmissions cover Asia, Africa and Europe. Tests are planned as follows.

KC	GMT
7165	0300-0400
9515	0100-0200
9575	0300-0500
11755	0430-0600

FLASHES FROM EVERYWHERE

MADRID over the Radio Nacional de Espania transmitters carries programs in Spanish for listeners in the Philippines, 1030, 1230GMT on 9695, 11715 and 15420KC. Madrid also uses 11705KC to Latin America 2300-0500 on 11805, 11880, 9360 and at times 9640KC.

BULGARIA with transmissions from Sofia is heard in Italian from 1800-1830 on 6070, 7255 and a new frequency 6245KC. Sofia from 2030-2100 also uses 6245 and 7255KC. The 6245KC channel is outside the usual 49 metre band.

KIEV in the Soviet Union has English Monday and Thursday from 1900-1930 on 7210 and 9760KC for reception in Europe, and also in English to North America 0030-0100 on 7180, 9660, 9680, 9810 and 11790KC. From 0430-0500 they use 7180, 9610, 9660 and 9680KC.

KUWAIT in its Arabic programs from the station on Kuwait in the Persian Gulf is at good level at 0600GMT on 9520KC. It is also reported that the transmission can be heard at 1000 through to normal sign off at 2100GMT.

ADDIS ABABA station ETLF has announced its transmission plans for the September-November period, with two 50KW transmitters. The first program is on the air 1315-1500GMT on 15420KC; 1500-1555 9555; 1600-1655 on 6010; 1700-1830 11845; 1830-1945 on 11845. Second transmission 1330-1430 on 9630; 1430-1600 on 9705; 1600-1630, 9650; 1630-

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A. C. E. RADIO

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CLYDE OR DUNLOP
19 Plate. 150 Amp.
Dry Charged. Cells.
£1/12/6 ea

A.C. D.C. MOTORS
32V and 110V
High Speed, Series Wound.
1/8 h.p. motors.
£1/17/6
Post. N.S.W. 7/6. Interstate 12/6.

NEW VALVES

1A3		7	6	12SK7		5	0
1A5		7	6	12SL7		12	6
1C5		7	6	47		12	6
1C6		12	6	76		7	6
1C7		5	0	84/624		12	6
1D5		5	7	304TH	1	10	0
1F5		10	0	723A	3	0	0
1G4		7	6	803	3	0	0
1H5		7	6	807	1	0	0
1H4		7	6	809		17	6
1J6		12	6	813	3	10	0
1K7		5	0	829B and			
1L4		5	0	Socket	2	17	6
1M5		5	0	843	1	10	0
1N5		7	6	866A		15	0
1Q5		5	0	954		5	0
1T4		10	0	1603		5	0
2A3	1	0	0	1616		7	6
2C26		7	6	1619	1	0	0
2X2-879		5	0	1629		5	0
3A4		12	6	1050	1	0	0
3B7		10	0	9006		5	0
3D6		10	0	AV11		2	6
5U4		10	0	CA19	5	5	0
5X4		10	0	CK1013		15	0
5Y4		10	0	CV63		7	6
5Z4		10	0	CV66		7	6
6AC7		7	6	CV1102		7	6
6AG5		9	6	CV1133		7	6
6AG7		10	0	CV1136		7	6
6AJ5		5	0	EBC33		7	6
6AK5		10	0	EC70		4	0
6AL5		7	6	ECH33		15	0
6AM5		7	6	EF36		7	6
6AM6		7	6	EF37		7	6
6AN5		12	6	EF39		7	6
6AR6		12	6	EF72		4	0
6AN7	1	0	0	EF73		4	0
6AS7	1	0	0	EK32		15	0
6B6		7	6	EL91		10	0
6B8		7	6	KTW62/			
6BF6		10	0	6U7		7	6
6BL8		7	6	RL27		15	0
6BM8		7	6	RK34		7	6
6BY7		7	6	RK75		10	0
6C8		7	6	RK84A	3	0	0
6F6		10	0	VR65		5	0
6G6		7	6	VR75/30		15	0
6J5		9	6	VR105/30		15	0
6J6		7	6	VR150/30		15	0
6J6		10	0	VT502		12	6
6J7G		7	6	32		10	0
6K6		7	6	42		10	0
6K7		5	0	45		10	0
6N7		7	6	37		10	0
6SA7 Metal		7	6	49		10	0
6SC7		10	0	53		10	0
6SF7		10	0	59		12	6
6SG7		10	0	63		10	0
6SH7		4	0	89		10	0
6SJ7		9	6	77		10	0
6SK7		12	6	2V3		7	6
6SN7		7	6	OZ4		7	6
6SS7		12	6	CL4		12	6
6X5		7	6	EM1		12	6
7C5		5	0	EL32		12	6
7N7		7	6	TZ40		10	0
7W7		5	0	6AB7		7	6
12A6		5	0	6A3		12	6
12AT7		10	0	6C6		12	6
12BE6		10	0	6F7		12	6
12BH7		7	6	6SC7		7	6
12C8		12	6	7A6		7	6
12SJ7		12	6	9006		5	0

GENEMOTORS

Input	Output						
12v	600v	300mA	New	£5	10	0
12v	500v	350mA		£8	10	0
12v	1200v	200mA		£6	10	0
24v	250v	100mA	New	£2	0	0
24v	540v	200mA	New	£2	0	0
24v	300v	250mA	New	£2	15	0
12v	275v	110mA		£3	15	0

CHASSIS PUNCHES
SIZES ⅝", ¾", ⅞", 1".
1⅛" with tapered
Reamer and Carry Box.
£2/17/6
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1960 5in CRO	5	17	6
325 x 325 150MA	4	15	0
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240V-110V 1.3KVA Auto	10	10	0
150 x 150V 30 MA	1	7	6
225 x 225V 40 MA	1	10	0
124V Doubler 300MA	3	7	6
130V Doubler 400 MA	3	17	6
145V Doubler 450 MA	4	17	6
150V Doubler 500 MA	5	7	6
220V Doubler 600 MA	7	7	0
310 x 310 170 MA	2	9	6

3" SELSYN MOTORS—TRANSMITTERS
50 V AC — 50 cps.
£2/17/6 each
Post 7/6; Interstate 10/.

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6V, 3-pole Miniature		15	0
12 volts, DPDT, 5 amp	£1	0	0
12 volts DPDT		12	6
100pf TX var. condensers		10	0
Hi-speed Polarised relay	£2	10	0

PMG TYPE 3000
2000 ohms 12/6.
1000 ohms 12/6.

Lapel Crystal Mikes		12	6
Crystal Mikes with switch		15	0
Telephone Pick-up Units		12	6
Contact Pick-up Units		15	0
100UA Stereo Bal Meters	£1	15	0

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.5mfd 600V		3	6
2mfd 600V		6	6
1mfd 600V		6	6
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4mfd 2.5K	£1	10	0
1mfd 3000V		17	6
.5mfd 5K, .1 5K, .1 3K AC .25 4K, .5 2½K ea.		15	0
4 mfd 3000	1	15	0
2 mfd 3000	1	5	0
1 mfd 3000	1	0	0
1.25 mfd. 6000v.	2	5	0
mfd 4000v.	1	10	0
2 mfd. 2000v.		15	0
4 mfd. 1500v.		15	0
1 mfd. 1500v.		10	0
8 mfd. 600v.		10	0
1 mfd. 1000v.		10	0

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300 PF+ 200 PF+ 60 PF
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5 Ohm	£1	2	6
2000 Ohm	1	2	6
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American Lightweight		12	6
Australian DLR		12	6
Dynamig Earpieces, pr.		4	6

Post., 2/6 pr.

100 NEW ASSORTED RESISTORS
Mainly I.R.C., ½, 1.2 Watt.
04 Values. ½ ohm. to 10 megs.
15/-, Post 2/6
100 new assorted Condensers.
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Communications Receivers. Test equipment. P.A. Gear. Large or small surplus stock. Best prices. Call, write or phone, any time.

TRANSISTORS
American Units.

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2N 174	2	10	0
2N 442	2	5	0
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High-powered units for 75-watt audio, 200-watt power units or transistor ignition.

T.B.Y. TRANSCEIVERS
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4 Band units. Variable tuning.
£14/17/6
Complete with aerial, Headphones, microphone, junction box, plugs and cables.
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4 to 5.3 or 5.3 to 7 Meg.
Less Crystal.
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2¼in 50 UA	£2	7	6
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2¼in 500V. D.C.	£1	15	0
3⅜in 500V. A.C.	£2	17	6
3⅜in 500V. D.C.	£2	10	0

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Current Navy Receiver
6 Band .40 K.C. to 32 Meg. Variable Selectivity. 2 R.F. 2 I.F. Stages. Crystal Gate Band Spread. New condition. Air-tested. Realigned 240V A.C. operation.
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455 KC. Balanced or unbalanced as required.
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4 Band, 500Kc to 30 Megs. B.F.O. S. Meter. Noise Limiter. Band Spread. 240v A.C.
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4-speed 240V A.C. 3000 R.P.M.
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TYPE T-503 3"
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160 watt, 50 Cycle.
24v to 32v input.
Output can be supplied for 50-110 or 240v as required.
Suit radiograms, TV, Tape Recorders. Fluorescent Lights.
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450 Watt, as above.
£36/17/6

12 VOLT UNITS
240V. 50 Cycle. 160 Watt
Will Operate TV Sets.
£19/17/6

1715, 9755; 1730-1815, 9555; 1815-1930, 9705KC. Frequencies will be subject to change, but ample warning will be given in station announcements. The ETLF Gospel programs are beamed to India, the Near and Middle East, and Africa.

MONGOLIA over Radio Ulam Bator is reported with an additional English session, 1420-1520 on 11850KC. The station states it is on the air 1420-1520 on Tuesday, Wednesday, Friday and Saturday on 9540 and 11850KC.

LOURENCO MARQUES Radio is at present testing two new 25KW transmitters, in conjunction with the facilities of the Radio Club of Mozambique. The English program is on 9585KC and the Portuguese on 9620KC. Both transmitters sign on at 0715, and are heard as late as 1315. Reports are requested from listeners hearing these two new transmitters on the air on a test basis.

IERRA LEONE Broadcasting Service in Freetown, has verified a listener in Europe with the details of its transmissions on 3316KC, and is on the air weekdays 0600-1015, 1545-2300, Sunday 0600-1015, 1300-2115GMT.

GAMBIA Radio at Bathurst is on the air from Monday to Friday 1710-2030 on 4820KC with BBC news at 1800, local news 1810, and vernacular languages 1820.

LANDESTINE station known as "Radio Free Iran," is now known to be located in Sofia, Bulgaria, and carries programs in Arabic and Persian beamed to Iran and Iraq. The station is on the air 1330-1815 on 9560, 11410 and 11695KC. The programs are presumed to be recorded in East Germany for transmissions to Iran and Iraq.

UNGARY'S English transmission to the United Kingdom 1930-2000 is on 7305 and 9833KC: 2200-2230 on 6234, 7215, 7305 and 9833; 2330-2400 on 6234KC. To North America from 0030-0100 and 0130-0200 on 6234, 7305, 9540 and 9833KC; 0300-0400 on 6234, 7215, 7305 and 9833. To the Middle East, 1600-1630 on 9833, 11910 and 15190KC and 1800-1830 on 7220, 9833 and 11910KC.

SRAEL'S Arabic service from Jerusalem, is on the air 0430-0515, 1115-1215, 1530-2115 on 7189KC. The transmissions have been continuously jammed by Egypt, but a report from Switzerland states the jamming is now less effective.

BROADCAST BAND NEWS

PACIFIC ISLANDS TRUST TERRI-ORIES. Radio services in the Trust Ter-itories of Marianas, Marshall and Caro-ine Islands, have been expanded, and hese details are contained in the Summer upplement of the World Radio Handbook. he time of all the stations in this area is 0 hours ahead of GMT.

ocation	Call	KC.	KW.	GMT
onape	WSZD	1450	1	2030-1200
oen	WSZC	1500	1	2030-1200
aipan	KJQR	1350	1	2030-1200
oro	WSZB	1500	.25	2030-1200
ajuro	WSZO	1440	1	2030-1200

A sixth station with the power of 1KW to be opened in Koror shortly.

Hawaii—The latest station to come into peration in Hawaii is KUAI, which is ocated at Eleele, Hawaii, and broadcasts n 720KC with 5KW. The station has been eard since early August from 1530 to 600GMT, which is early morning reception n our area. The signals are fair and the rogram is of light music with announce-nents in English by a woman announcer, while a man gives announcements in awaiian.

The station suffers some interference from eking on the same frequency, as well as, o a lesser degree, from 6CA and a Jap-nese station. After 1600 interference is essened on the channel and KUAI in Eleele an be heard to fade out at 1615. This is the latest of the many Hawaiian stations to be heard, all of them, with the exception of the one on 1310KC, can be heard most mornings in this area with KGMB 590, KORL 650, KGU 760, KHVH 1040 and KUMU 1500KC being most consistent.

INTERNATIONAL WATERS. Radio Caroline South, operating in the English Channel has boosted its power to 50 KW and operates on 1492KC. The three major pirate stations Radio Caroline North, off the Isle of Man, Radio Caroline South, off the south coast of England and Radio London in the Thames Estuary, now claim some 13 million British radio listeners each day. The greatest density is in the London area now served by Radio London and Caroline South both with 50KW. In East Anglia a recent survey showed radio daytime audience was over 77 per cent tuned to either Radio London or Radio Caroline South, making a major slice in the BBC radio audience. Recordings of all the pirate radio stations were recently sent to us by Roy Patrick of Derby, England, and the presentation is typical of American and Australian fast moving commercial format, with news, weather and popular music the main ingredient in the programs.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are in GMT, add 8 hours for Perth, 10 hours for Sydney, and 12 hours for Wellington time. All frequencies are in kilocycles.

Details of the stations now in operation off the coast of Britain and other European countries were recently given in a World Publications bulletin. The details on station, address, frequency and power are as follows:

RADIO CAROLINE NORTH: P.O. Box 3, Ramsey, Isle of Man. Station is located on MV Caroline, anchored 4 miles off Douglas, 1520KC. 10KW.

RADIO CAROLINE SOUTH, 6 Chesterfield Gardens, London W1. Anchored 4 miles off Harwich, on 1492KC, 50KW.

RADIO CITY, 7 Denmark Street, London WC2. Located on gunsite in Thames Estuary, 1033KC. 6KW. 1261KC. 650W.

KING RADIO, Oxford House, Folkestone Kent. located on gunsite off the coast. 1268KC. 1KW.

RADIO LONDON, 17 Curzon Street, London WC2. On former minesweeper in Thames estuary, 1133KC. 50KW.

RADIO SYD, Melmo 4, Sweden, located off the coast of Sweden and broadcasting on FM 88.3MC 7KW.

RADIO VERONICA, P.O. Box 218, Hilversum, Holland, located off the Dutch coast, on 1562KC. 3500W.

Other stations reported to be in operation or due to come into service include Radio Albatross on 1558KC, Radio Landey 600 KC, in Dublin Bay, Radio Shannon 1439 KC, Radio Atlanta off the coast of Belgium

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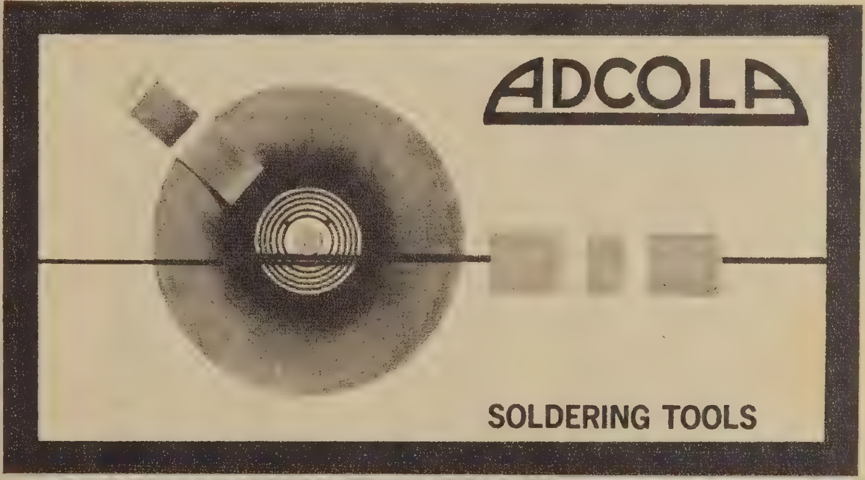

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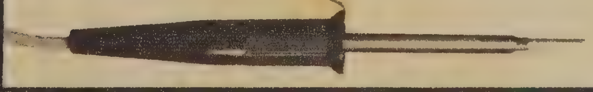

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and Star Club Radio to operate off the coast of West Germany.

PHILIPPINES Radio DXKE was officially opened last December 19, according to information received from the Far East Broadcasting Company in Manila. The station, previously reported in these pages is now in daily operation, using 1060KC with 1000 watts. The station is located at Kings Institute, Marbel, Mindanao, Philippines, and is on the air for four hours each day, 0900-1300 GMT, but plans to increase this schedule are under consideration. The station uses English, Tagalog and several other local languages. The station is located on the campus of an evangelical training centre, and the call DXK1 is derived from Kings Institute, the site of the station.

Another change in the Philippines is a call change on 1000KC, used by the former DZBC in Manila. We hear this station closing at 1600GMT and it now announces as DZMN. It has increased power to 10 KW, and is operated by Bolinas Electronics Manila and affiliated with the ABS, the Philippines' largest network.

TELEVISION NEWS

Plans for television service in Noumea, New Caledonia, are expected to come into operation this month, using three transmitters located on three high points in the Noumea area, according to reader John Nixon of Noumea.

Noumea, with a population of about 40,000, is well spread out on a very hilly peninsula, and the ground has a very high nickel ore content. The French Radiodiffusion decided to install three low-powered transmitters on the three dominant hills of the town, using three steel towers 120 feet high. The transmissions will be on the VHF bands using the following frequencies.

Channel	MC (Picture)	MC (Sound)	Location
K4	175.25	181.75	Oun Toro
K6	191.25	197.75	Maiso de la Radio
K8	207.25	213.75	Semaphore

The transmissions will use 625 lines with FM sound. Mr Nixon reports the majority of the material will be in film from the ORTF in Paris, but full studio facilities are also being installed, and a small content of local material will be included. Mr Nixon would be pleased to hear of any readers, who are interested in television DX, and his address is, c/o 45 Rue de L'Alma, Noumea, New Caledonia.

TV TRANSLATORS IN NEW ZEALAND

The annual report of the New Zealand Broadcasting Corporation shows that at March 31, 1965, 34 private translators were in operation in New Zealand under the ownership of private television societies to boost the NZBC TV program into secondary coverage areas. These translators have a limitation of power of 25 watts, and the societies are subsidised by the NZBC. A further 70 mini-translators or mini-repeaters, which are not subsidised and have a power limitation of 5 watts, are also in operation, and boost the program to isolated communities, or even to single homes, in "shadow" areas. All these stations are licensed by the New Zealand Post Office, and the higher powered ones use Channel 4, 5 or 6. NZBC has four television programs, which originate from Auckland Ch2, Wellington Ch1, Christchurch Ch3 and Dunedin Ch2, which are in turn boosted to other areas. Basically, this is in the north of the North Island for Auckland, southern North Island for Wellington, north of the Waitaki River for Christchurch, and south of the Waitaki, the southern section of the South Island, for Dunedin. Present licences for receivers are now at the stage when 49 per cent of the homes have television, still a long way behind the Australian figure of nearly 90 per cent, but television in New Zealand is only four years old. ▭

TECHNICAL BOOKS AND PUBLICATIONS

ADVANCED SERVICING TECHNIQUES prepared under the sponsorship of the Electronic Industries Association. Two volumes, Hard covers, 8½ by 11 inches, 298 and 178 pages with excellent illustrations and colour plates. Published by John F. Rider Publisher, Inc. New York, U.S.A. Australian selling price Volume 1, £5/3/6, Volume 2 £3/14/ plus post and package where applicable.

The first volume of this series is devoted to service techniques associated with colour and black-and-white television. Being an American publication, the standards involved are different from those in Australia but the similarity of the two systems allows full use to be made of the text. In some cases, specific chassis types are nominated but always with a sample circuit for comparison purposes.

The colour plates used throughout the volume are of high quality and the illustrations given allow the text to be followed with ease. The various chapters in this volume include: TV Test Equipment; Printed Circuit Servicing; CRT Display Section Servicing; Chroma Section Servicing, etc. So it continues through the various sections of both colour and black-and-white TV sets to end with material on Antennas, Television Interference and Transistor Television Servicing.

While a substantial portion of this first volume is devoted to colour television, which has not as yet started in Australia, it could make an excellent reference volume for the TV technician.

The second volume of the set deals with he service of Stereo Amplifiers, FM and FM Multiplex, Record Changers, Tape Recorders, Home Intercoms and Combinaion Receivers. While again such things as FM Multiplex are in the future for Ausralia, knowledge of the principles involved are no load to carry. The text is well illustrated and servicing techniques fully explained.

The combination of these two volumes makes an attractive library which we can horoughly recommend for the progressive echnician. Our copies from the distributors, the Grenville Publishing Co., Sydney, who advise that copies should be available rom all leading booksellers. (K.W.)

* * *

BUILDING THE AMATEUR RADIO STATION, by Jack Berens and Julius Berens. Soft cover, 134 pages 5½ by 8½ inches with circuit diagrams and photographs. Published by John F. Rider Publisher Inc., New York. American price 3 dollars 45 cents.

This book has been written mainly for the enfit of the American Novice-class mateur radio operator. We do not have n equivalent class of licence in Australia nd the contents of this publication therefore have little application in these circumances. It seems to us that the beginner and he more advanced amateur alike could ain more knowledge from other publicaons better suited to Australian conditions.

In brief, an American book for American mateurs. Our review copy direct from the ublisher; Australian price not quoted. K.W.)

* * *

MODERN ELECTRONIC VOLTMETERS, by Sol D. Prensky. Soft cover, 5½ by 8½ inches, 224 pages complete with circuits and diagrams. Published by John F. Rider Publisher, Inc., New York. Australian selling price £3/1/6 plus post and package where applicable.

In this book the author discusses what ays behind the panel of the ubiquitous lectronic Voltmeter. The functions of typial instruments are discussed in detail so that the serviceman or technician may visualise what takes place when making measurements with the instrument. Knowing the system used in an instrument allows the technician to obtain the maximum benefit from it.

The coverage is a good deal wider than one might, at first glance, expect from the title. Instruments discussed by the author are Diode Voltmeters, Elementary DC VTVM's, General Purpose AC-DC VTVM's, Transistor Voltmeters, High Sensitivity AC Voltmeters, High Sensitivity DC Voltmeters, Electronic Microammeters and Galvanometers, Digital Voltmeters and Potentiometric Voltmeters and Recorders.

As each instrument is featured, the text goes on to explain the type of tests which may be performed with it, as a class.

This book is well written and will certainly appeal to anyone involved in the design, service or sale of electronic voltmeters. However, because of the wide field of instrumentation covered, the book should be of potential value to a wide section of people engaged in electronics generally. Our

DIGITAL INSTRUMENTS

DIGITAL INSTRUMENTS, by K. J. Dean, B.Sc. Crown 8vo, 181 pages, many circuits and diagrams. Published by Chapman and Hall Ltd., London. Price in Australia 42/6 plus post and packing 1/3, where applicable.

If we are to judge by the articles and advertising in English and American trade and professional journals, digital instruments are growing steadily in popularity in these countries. No longer does the research scientist or developmental engineer take his measurements using instruments as prosaic as the meter, potentiometer or heterodyne frequency meter; he uses digital voltmeters, frequency meters, counters or even a digital Q meter, of a cost and complexity which can make the well-known multimeter look like a child's toy.

While as yet the situation here in Australia does not appear to have reached this stage, it will no doubt do so eventually. Although out here electronics is not as "big" as it is in many overseas countries, and lacks much of the impetus provided and required by huge defence programs, it cannot escape the ever-growing trend towards greater precision of measurement.

As electronic devices become increasingly more complex the need for making measurements with increasingly greater accuracy grows with them; traditional instruments like the moving-coil meter are fast becoming obsolete, whether we like it or not.

Even in this country, then, digital instruments are virtually upon us; a rather frightening fact for many of us, because the complexity of many of these devices and the relatively unfamiliar nature of the principles upon which their operation is based raise problems not only of design and maintenance but also of effective operation. "Learning to drive" a digital instrument effectively may prove quite a challenge even for the experienced engineer or scientist.

Clearly the time has come, as Lewis Carroll's walrus once observed (albeit in a different context), when we must speak and learn of many things. At almost all levels in electronics we are going to have to become familiar with circuit logic, counting, gating, pulse techniques and the many other facets of digital technology, and this task is going to require a considerable body of well-written tutorial material.

In view of this need, the modest volume which forms the subject of this review must be of considerable interest. Intended as a general introduction to the field of digital instruments, at a fairly advanced level, it is written by the head of the department of science and electrical engineering at Letchworth College of Technology. Previous books by the same author include **"Transistors: Theory and Circuitry"** and **"Counting Techniques and Transistor Circuit Logic,"** the latter volume reviewed in these columns in the May 1965 issue.

The chapter headings give a fairly good idea of the material covered and the approach adopted:

1. Information Theory and Digital Codes.
2. The Principles of Transistor Switching Systems.
3. Input Devices.
4. Output Devices.
5. The Measurement of Frequency and Time.
6. Digital Voltmeters.
7. Ramp Function Digital Voltmeters.
8. Voltage-frequency Conversion.
9. Other Digital Instruments.

An appendix discusses the assessment of the accuracy of digital voltmeters, and the rear of the book includes a short bibliography and a set of thirty problems concerning the initial theory chapters. Numerical answers to the problems are given, apart from the questions themselves.

The impression gained upon reading sections of the book is that it would be a worthy introduction to the topic. The level is fairly high, however, and one should ideally be familiar with the material covered by the author's other two books to use the present volume to best advantage.

When I reviewed the author's book on counting techniques some months ago I remarked upon the concise and easy-to-read style; in general this is again evident here. However, to my mind, there is a short section of the book which falls somewhat short of the commendably high level of communicability maintained elsewhere: this is the section on information theory, in the first chapter.

Only a little more than a page in length, this section would seem to contain material which is compressed beyond the point where it is of use to those who don't already know what the author is writing about; a shortcoming particularly ironic in view of the topic concerned. Perhaps, in the language of information theory, the redundancy of the communication has been reduced to the point where none but a preprogrammed receiver can decode it . . .

However, despite this short lapse in style (in my opinion) the book as a whole must be warmly recommended. It would seem ideal as an introduction to digital instruments, suitable for the later-year engineering or science student, the advanced technician or the engineer.

Our review copy came from the Technical Book and Magazine Co., of 295-299 Swanston Street, Melbourne, from whom copies may be purchased by mail. (J.R.)

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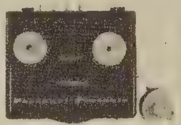

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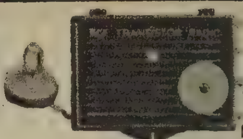

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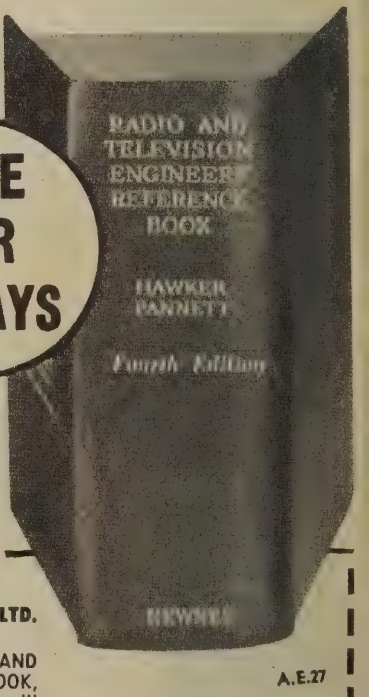

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copy came from Grenville Publishing Co., Sydney, who advise that copies should be available from all leading booksellers.

* * *

TRANSISTOR IGNITION SYSTEMS, by Marvin Tepper. Soft cover, 128 pages, 9 by 6 inches. Text material with many illustrations. Published by John F. Rider Inc., New York. American price 2 dollars 95 cents.

In this new book, Marvin Tepper has provided an authoritative text on transistor ignition. The book assumes no prior knowledge of either automotive electrical fundamentals or semi-conductor theory and would thus be most useful to either the hobbyist or the professional serviceman.

From the known sales of complete and kit-set transistor ignition units in this country, it would appear that the system is enjoying quite a deal of popularity. Transistor ignition will eventually become an optional extra and then a standard fitting on many new vehicles and, when this happens, there will be a big demand for people able to properly service the systems.

The book's 9 chapters cover: The Automotive Ignition System, Conventional Ignition System Components, Semi-conductor Operation, Zener Diodes and Transistor Operation, Transistor Circuits, Transistor Ignition Systems, Commercial Transistor Ignition Systems, Transistor Ignition Systems Installation, Troubleshooting Transistor Ignition Systems.

Actual, working transistor ignition systems are not mentioned until page 51 in the book, but the first 50 pages are well spent covering fundamentals, indeed a true understanding of transistor ignition requires a specialised and related knowledge of transistors and automotive electrics not normally covered by those experienced in either field.

Our review copy of this volume came direct from the publishers but copies should be available from local booksellers in due course. Recommended. (KWJ).

* * *

THE RADIO AMATEUR'S V.H.F. MANUAL, by Edward P. Tilton. Soft cover, 6½ by 9½ inches, 318 pages of well-illustrated technical information. Published by the American Radio Relay League, Newington 11, Connecticut, U.S.A.

Further copies of the above publication are to hand from the publisher and McGill's Authorised Newsagency. The latter quote the Australian selling price as 28/6 plus 1/6 postage. McGill's Authorised Newsagency is situated at 183 Elizabeth Street, Melbourne. For a detailed review, see our September, 1965, issue.

BROCHURES AND DATA SHEETS

THE STANDARDS ASSOCIATION OF AUSTRALIA is seeking constructive criticism and comment on a draft Australian approval and test specification for lighting fittings issued as Doc. 970. This draft applies to both incandescent and fluorescent lighting fittings intended for use in a fixed position for either indoor or outdoor applications. Copies of Doc. 970 may be obtained from the headquarters of the Association, Science House, 157 Gloucester Street, Sydney, or from Branch Offices in other capital cities and Newcastle. Comments on the draft should reach the Association not later than November 30, 1965.

EMERSON AND CUMING, INC., of Canton, Massachusetts, have produced new six-page fold-out brochure describing the "Eccosorb" line of microwave absorbers — both for free space and for waveguide applications. The brochure presents a thumbnail description of each product, together with performance data so that selection can be made rapidly. Photographs illustrate the use of many of the products. Copies of the brochure may be obtained from Wm. J. McLellan and Co. Pty. Ltd., of The Crescent, Kingsgrove, N.S.W.

S.T.C. COMPONENTS AND EQUIPMENT REVIEW for July, 1965 (Vol. 2, No. 7) has articles on the tunnel diode and the Shockley 4-layer diode. Brief details are also given of a new S.T.C. 100KW ceramic RF power triode, and of miniature industrial relays type 24 and 25. (Available from the Editor, Industrial Products Division, Standard Telephones and Cables Pty. Ltd., Moorebank Avenue, Liverpool, N.S.W.)

N.B.S. TECHNICAL NEWS BULLETIN for June 1965 (Vol. 49, No. 6) has articles on the use of a computer to plot potential damage from a nuclear explosion; the establishment of a pD scale; thermal radiation from shallow cavities; frequency stability calibration or signal sources; the mechanical properties of glass as revealed by heat treatment; and details of new standards and publications. (Sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Annual subscription 2.25 dollars.)

RADIOTRONICS for June (Vol. 30, No. 6) has articles on "Further Experiments in Electronics," "Ferrite Isolators and Circulators," "Radio Propagation and the Amateur Radio Operator," and book reviews. (Amalgamated Wireless Valve Co. Pty. Ltd., P.O. Box 63, Rydalmere, N.S.W. Annual subscription 20/.)

MINIWATT DIGEST for August 1965 (Vol. 4, No. 11) has articles on a general purpose battery charger, using silicon diodes; on photosensors for various applications; on a cold cathode trigger tube timer; on a low drain transistorised audio output stage and on positive temperature coefficient resistors. (Miniwatt Division, Philips Electrical Pty. Ltd., 20 Herbert Street, Artarmon, N.S.W.)

SIGMA INSTRUMENT INC. have available on request a 4-page bulletin describing a compact and versatile 4-pole double-throw relay with a 50 pps response rate. With a typical load-life capacity of 400,000 cycles at 5A the new relay is ideal for telecommunications, computers and many data processing applications. It is designated the Series 44DC. (Sigma Instruments, Inc., 170 Pearl Street, Braintree, Massachusetts, U.S.A.)

KEPCO INC. issue a six-page newsletter concerning releases and applications of the firm's regulated power supplies. The sheet just received (Vol. 5, No. 146-1089) gives details of the application of a versatile group of power supply modules designated as "PAX," also brief details of new instruments released. (Kepco Inc., 131-8 Sanford Avenue, Flushing, New York. 11352)

TECHNICALITIES, a product review published by Tecnico Electronics Pty. Ltd., has details of printed wiring board and sub-assembly wiring facilities available from the firm. Also given are reviews of Shaw Hygrometers; products from Gulton Industries, Inc. (U.S.A.); Dytronics tunable filters, spectrum analysers, phase measuring equipment, phase sensitive voltmeters, electrolytic capacitor analyser, and variable frequency phase sensitive voltmeter; the model 350 AC Gaussmeter from F. W. Bell Inc. (U.S.A.); new Bach-Simpson (U.S.A.) test meters; transistor amplifiers from Newmarket (U.K.); a Filmohm UHF A-T voltmeter; and the line of testing and measurement instruments manufactured by Transmetrics Inc. (U.S.A.) (Tecnico Electronics Pty. Ltd., Carrington Road, Marrickville, N.S.W.)

THE AIRTRON DIVISION OF LITTON INDUSTRIES have issued a 28-page report on "Microwave Components for Communications Systems." The report, No. R11-457, describes the components available for line-of-sight, troposcatter, and space communications systems. Included are typical specifications for waveguide, isolators, circulators, filters, loads, switches, feed horns, and other systems. General system information and diagrams are also included. For a copy of this report, apply on company letterhead to Airtron Division, Litton Industries, 200 East Hanover, Avenue, Morris Plains, New Jersey.

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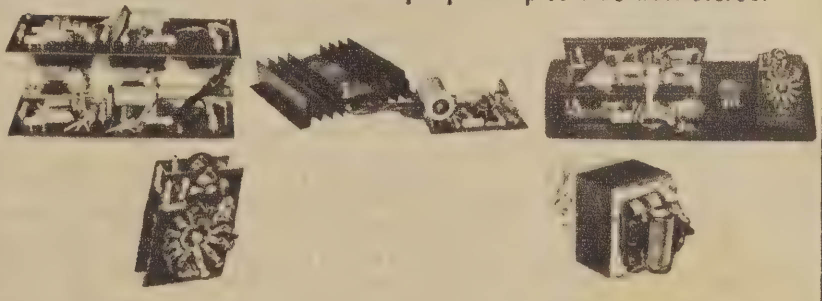

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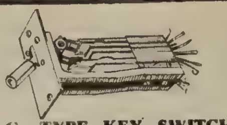

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6U7 . .	7/6	12SK7 .	5/
VI103 .	10/	VR1120 .	5/
VH120 .	7/6	VR118 .	7/6
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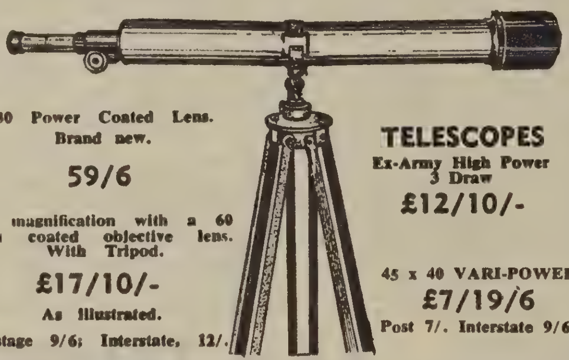

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When writing to us:—

- **Please give your name and full postal address, including the State . . . N.S.W. &c.**
- **Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.**

GUITAR AMPLIFIER

.B. (Perth, W.A.) writes stating an interest in the guitar amplifier in the October, 1962, issue and commenting that the article did not mention the selling price.

irst, we must emphasise that we do not rticipate in the marketing of any of the ojects described in the magazine and, as result, we cannot quote a price on these ojects. Several of our advertisers sell kit-ts or wired versions of our construction ojects at prices related to their own pro-ction costs. For further information re e advertised components and packages it necessary to write direct to the advertiser.

The guitar amplifiers featured in October, '62, and January, 1963, both featured a brato footswitch outlet. Details of our pro-cts are available through the query ser-ce for a nominal fee of 2/ per section.

SUCCESSFUL RECEIVER

O. (Royal Park, S.A.) says that he built a simple transistor receiver from a 1957 issue of "Radio, Television and Hobbies." It was not sufficiently selective but he was able to improve matters considerably by substituting a toroidal coil for the one specified.

ou seem to have done a good job with e little set and we are happy to know at it is working so well. Keep up the od work.

3-BAND THREE

W. (Spring Vale, Vic.) has constructed the 3-Band Three receiver of August, 1957, and is experiencing trouble with a loud whistling noise.

rst, it is necessary to determine whether behaviour you describe represents a ult in the receiver, or is simply normal haviour not properly appreciated. Since set is a regenerative type, it is quite rmal for the detector stage to go into cillation when the regeneration (not vol-ne) control is advanced too far. Part of trick of using these sets is to be able set this control just below oscillation, ere maximum sensitivity and selectivity obtained. This type of oscillation will rmally change pitch as the set is tuned ross a station. However, if the oscilla-n occurs when only the volume ntrol is advanced, it would suggest a ult. One possibility is that RF in the te circuit of the detector stage is finding way into the following audio stages and pearing in the output circuit; from here may couple into the aerial circuit and s provide an unwanted regenerative loop. is RF is normally filtered out of the dio signals by the small capacitor from detector plate to chassis. If this capaci- is faulty or not large enough in value could produce such an effect. Another ssibility is that the audio amplifier itself unstable, due to either a faulty com-nent or poor layout. Any layout which allows output signal leads to run in close proximity to input leads could be unstable, particularly when the volume control is advanced. Alternatively, a faulty decoupling capacitor on the HT line (16uF in association with .01M resistor) could allow audio signals generated in the output stage to appear on the HT line feeding the detector, and thus find its way to the input of the audio system. In some cases it may also be beneficial to parallel this capacitor with a small value paper unit to ensure adequate by-passing at high audio and radio frequencies.

YOUTH RADIO SCHEME

M.L. (Port Kembla, N.S.W.) asks for details of the Youth Radio Scheme and requests more articles for beginners.

While we are not directly connected with the Youth Radio Scheme we certainly consider that it is doing an excellent job. We suggest that you write to the Wireless Institute of Australia, N.S.W. Division, 14 Atchison St, Crow's Nest, N.S.W. The W.I.A. are the founders of the YRS and would be happy to supply details. We have certainly not lost touch with our young readers and try to present as many articles as possible which will help both in construction and theory. However, we must give some of our advanced readers a chance to exercise their knowledge also.

INFORMATION SERVICE

M.C. (Ipswich, Qld.) forwards a list of construction projects in which he is interested and inquires as to the cost of supplying the relevant articles through the query service.

This question is raised from time to time by various readers. The standard charge through the query service is 2/ per article where such article was published in one part. If the complete article was in, say, four sections published over a period of four months then the charge is 8/. Where photo-copying is necessary—and practical—this is supplied at a flat rate of 2/ per page. In the case of very old publications we are sometimes unable to supply complete articles and in this case circuit diagrams or any data available are forwarded. Where a query only is involved and no additional articles supplied then the charge is 2/. When requesting articles for which the date of publication is not available, please assist by giving a complete description of the project such as valve types, power output required, valve or transistor, intended application, etc.

HUM PROBLEM

J.D. (Dee Why, N.S.W.) sends a circuit of an intercom fabricated from our Little General circuit and queries a hum trouble encountered in the alteration.

Our query service is designed to handle readers' problems with original circuits as published in the magazine and we cannot spare the time to check circuits forwarded by readers or supply information on commercial equipment. However, at a casual glance we would say that the hum is being picked up by the additional speaker (input) transformer, by induction between the slave unit cables, or by ground loops in these cables. The input transformer is the most likely cause, and normally needs very complete magnetic shielding and careful orientation with respect to the power transformer.

STEREO-MONO PROBLEM

R.S. (Essendon, vic.) asks in his letter why a stereo stylus could not be substituted in a mono player so that mono and stereo records could be played at will.

Quite apart from stylus dimension, there is the vital matter of vertical compliance, which is not necessarily provided in mono cartridges. Unless the cartridge is known specifically to have adequate vertical compliance, it is likely to damage stereo records stylus size notwithstanding. Incidentally, at the instigation of another reader, we prepared a more lengthy discussion of this question for the "Answer Man" feature.

COLOUR CODE PROBLEMS

M.P.F. (Darwin, N.T.) sends a sketch of a potentiometer-switch and a transformer, both with colour codings. He wishes to know the correct identification for these components.

Unfortunately, there is no truly universal standard colour code for transformers and it is therefore impossible to nominate the connections or voltages by the colour of the leads. This also applies to the switch-potentiometer. Usually, the switches on these components are double-pole types and identification should be possible with a simple continuity check.

"ELECTRONICS Australia" INFORMATION SERVICE

TO assist readers, "ELECTRONICS Australia" conducts a technical information service.

Conditions governing this service are set out below:—

(1) Address letters to: Assistant Editor, "ELECTRONICS Australia," Box 2728, G.P.O., Sydney.

(2) Requests for copies of circuits or technical information requiring a postal reply must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(3) For the 2/ fee, we will supply circuit data, as available, from our files. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuits will be answered more speedily if they are not complicated by questions requiring the attention of technical personnel Where articles are not on file we can usually provide a photostat copy at 2/ PER PAGE.

(4) The information service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits. Please note that the inclusion of an extra fee does NOT entitle correspondents to special considerations.

(5) The editor reserves the right to return fees or to limit the scope of an individual reply when it is felt that a partial answer will be better than none at all.

(6) In addition to the above service, chassis blueprints are available for most of our projects showing the position of holes and cutouts for metal-working, but containing no details of wiring. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in. x 8in. glossy print, postage 9d extra.

(7) "ELECTRONICS Australia" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications should be obtained from advertisers.

(8) Technical queries are not answered by telephone.

(9) We have no file of circuits for commercial radio or TV sets, etc.

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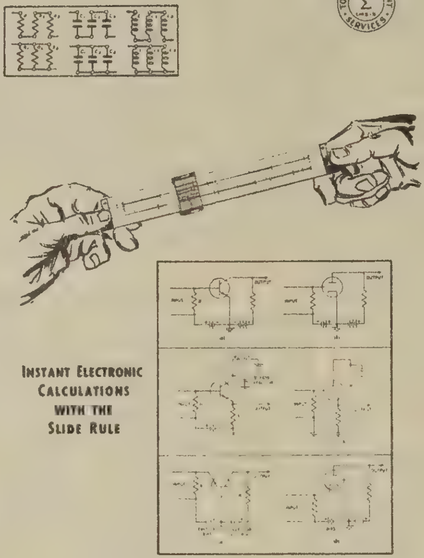

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No need for a library of design data.
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when you can calculate component values instantly. You can re-design and adapt overseas circuits to the parts you have or can quickly obtain — WITH THIS SLIDE RULE AND 8 LESSON ELECTRONIC KNOW HOW.

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TOROID BALUNS

(Continued from page 41)

ideal for use with a coaxial feedline and the "double doublet" wideband receiving antenna shown on page 51 of our March, 1965, issue. And if this, or any other coax. fed antenna, were being used with a receiver having a balanced input, the balun would be most effective in coupling the coax. to the input of the receiver.

The effective bandwidth of the balun is somewhat greater when it is used exclusively for receiving because a loss of 6dB at the end of its range might be tolerated where a 1dB loss would be the maximum for transmitting.

Under these conditions the balun has a usable range of 1.5 to 38MC. This is not to say, however, that the balun will not pass signals above or below these frequencies, but simply means that signals beyond this range will be attenuated by something more than 6dB.

Since most communications receivers do not cover above 30MC this leaves only the lower frequencies to worry about, most particularly the broadcast band of 0.5 to 1.5MC.

Those who are not worried about broadcast band DX (long distance reception) would find the balun passed signals at adequate strength, particularly where a large aerial was used.

By way of a test, we installed a 400ft "V" shaped dipole from the top of the 100ft tower which is mounted on our building and fed this dipole into approximately 300 feet of coaxial cable through, of course, the toroidal balun. Our receiver was the "Communications Eight" described in our January, February and March, 1965, issues.

This antenna consistently outperformed a large "inverted L" antenna elsewhere on the building down to approximately 1.2MC when the inverted L showed up as being the better of the two. However, there was no shortag of signal from the V-aerial, even at 550KC.

Those readers who particularly want good broadcast band performance might be prepared to accept some losses at the top (30MC) end of the band and if such is the case a modified form of the balun could be used.

A balun to give good broadcast band results can be constructed by using a thinner type of hookup wire and 20 trifilar turns in lieu of the 10 specified earlier.

THE SERVICEMAN

(Continued from page 63)

Unfortunately, I am not an SSB man making it difficult for me to offer a precise explanation of what happened when working in this mode. However reverting to the mechanism of hum modulation in the 6BE6, as already discussed, it is not difficult to imagine that this would differ according to the type of signal present. On the one hand we have a conventional signal with two sidebands and a carrier, and on the other only one sideband and no carrier. It would be surprising if they did not behave differently.

More important, from my point of view, was the fact that this differenc gave rise to a completely misleading se of symptoms, whereby the BFO becam the prime suspect.

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Advertisements in these columns cost only 5/- per line. Each line contains the equivalent of five words each of nine letters. Minimum size of advertisement is two lines. PAYMENT MUST ACCOMPANY ALL ADVERTISEMENTS EXCEPT THOSE PLACED BY ACCREDITED AGENCIES. Your advertisement for the November issue must reach our office before October 7th. Address your advertisement to The Advertising Manager, ELECTRONICS Australia. Box 2728, G.P.O., Sydney.

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RANSISTORS available, reduced prices, RF, AF. power. Write M. and R. Electronics, 309 Antill St., Watson, A.C.T.

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' Radio Electrical Sales and Service. Established 5 years, one owner. Under medical advice usiness must be sold. Going for value stock, orkshop equipment and fittings. Further parculars and references. Dear's Radio, Northam, V.A.

PE RECORDER BARGAINS. New and used achines. Buy from a technician, not a salesan. Free technical advice. All repairs and ccessories. Country inquiries welcomed. Tomn's Radio, 528 Liverpool Rd., South Strathield, N.S.W. 642-4215, Sydney.

LL. All back issues "R. TV & H." in stock at l times. 1939-1955 copies, 2/ each; 56-59. / each; 1960 to date, 4/ each. Post incl. hone, write or call, T. Weir, 56 O'Connor t., Haberfield, Sydney. 71-2569. Wanted to uy copies.

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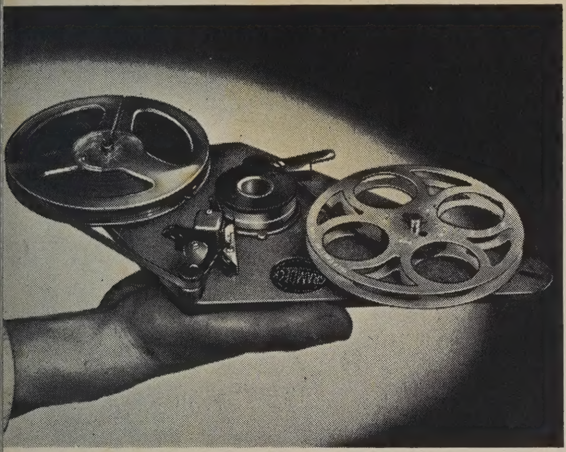

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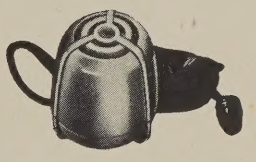

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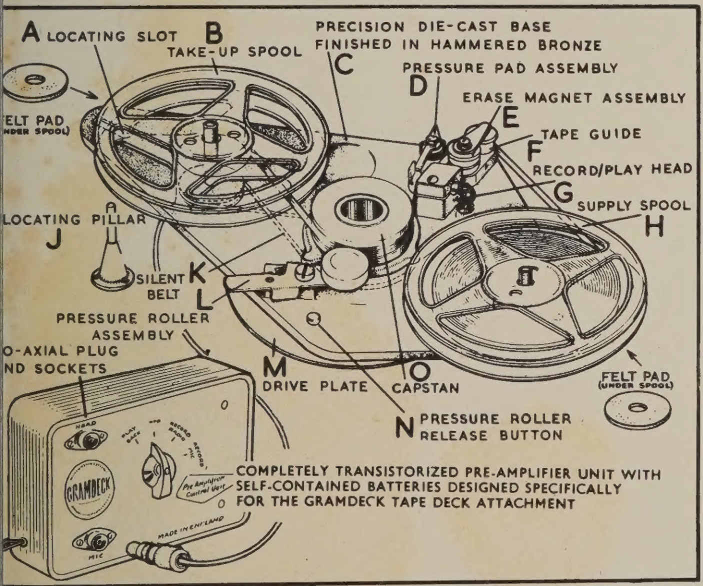

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in track head?	Yes.	Fit on record changers? ..	Yes.
tomatic erase?	Yes.	Tapes any speed?	Yes.
ise without recording? ..	Yes.	Easy to fit?	Yes.
erimpose?	Yes.	Spool sizes up to $5\frac{3}{4}$in?	Yes.
cord direct from radio?	Yes.	Very reliable?	Yes.

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ese unique Tape Recorders are imported from England and d direct by the Agents at the quite remarkable price of 4/10/ for the complete unit (Tape Deck, Pre-amplifier and crophone).

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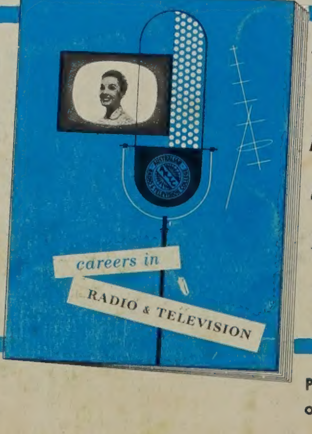

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